THE

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THE WAR AND RUSSIAN ELECTRICITY SUPPLY.

THE taxation of electricity is by no means a new project in Russia; indeed, it was first proposed at a time when the total consumption of electrical energy was so small that the tax simply languished for lack of victims. Considerably later, after the war with Japan, the proposal was revived, for by that time the Russian electrical industry had become too extensive to escape this unwelcome attention. Statistics showed the total output of Russian central stations to be 500,000,000 KW.-hours in 1905 and, though this estimate was probably much exaggerated, it encouraged the Minister of Finance to introduce in 1906-7 proposals for the taxation of electrical energy. These proposals were held to be equitable, seeing that users of petroleum (very extensively used for lighting purposes in Russia) had to pay a tax of about 5½d. per gallon. Without going into the ethics of taxing any artificial lighting medium, whatever its nature, or the detrimental effect of such a tax on public and private electric lighting, it is obviously a very serious matter to tax electricity for motive power, and, largely due to the energy with which the Société Impériale Technique demonstrated the disastrous influence of such a tax on Russian industry, the Government relinquished its proposals to tax power current but retained for a time a tax of 1d. a unit on lighting current. Subsequently this tax also was abandoned, but now, under the stress of circumstances, which compel advantage to be taken of every resource of the country, taxation of electrical energy seems inevitable.

So long ago as last February, the Electrotechnical Committee of the Société Impériale Technique conferred with representatives of the electrical and other industries of Russia, concerning the problems raised in the electrical field by the war, and particularly concerning this question of taxation. Investigation was made of the quantity of electrical energy produced. According to *Le Génie Civil*, it was found that the annual receipts of 102 stations consulted amounted to £2,500,000. The four large stations of Baku, Lodz, Moscow and Petrograd contributed £1,400,000 to this total, and their output alone amounted, in 1913, to more than four times the 1905 total for all Russia. This is shown by the subjoined figures in which line (A) refers to all Russian stations in 1905, and line (B) refers to the output of Baku, Lodz, Moscow and Petrograd stations in 1913.

Kilowatt-Hours for :—

	Lighting. Private.	Public.	Power.	Tramways.	Total.
(A)...	40,023,700	9,676,800	25,581,000	19,726,500	95,007,000
(B)...	75,151,000	6,906,500	207,083,000	89,695,800	378,836,500

With the exception of the largest cities, electric lighting is little developed in Russia, being sparingly used in large towns and very rarely in villages. The incidence of taxation on electricity would, therefore, be chiefly on energy used for power and traction.

Two immediate effects of a tax on current for lighting would be reduction in the amount of lighting, and the adoption of high-efficiency lamps. Both of these developments would be very injurious to Russian central stations (though the latter would prove beneficial in the long run), and would

probably reduce the yield of the tax far below official expectations. The public lighting tariff in Moscow was about 3d. a unit in 1905, but it had fallen to 1½d. in 1913, with supplementary supply at ½d. to ¾d. a unit. It would therefore be necessary to reduce public lighting by 50 per cent. or more to keep within the expenditure allocated to this service, supposing a tax of 1d. a unit to be imposed. Though precise data are not available on this point, there are in use in Russia many old and inefficient lamps which would surely be replaced at the earliest opportunity by tungsten and half-watt lamps under the spur of a tax on lighting current. Of course, it can only be a matter of a year or two at most before Russian central stations have to face this problem in any case, but no doubt a lighting tax would hasten the crisis and make it much more acute. By using the latest lamps the consumer could still effect economy, the tax notwithstanding, so that the immediate burden of taxation would virtually be thrown on the lighting revenue of the central station.

The system of taxation applied to petroleum cannot be applied directly to electricity. The cases are fundamentally distinct. Oil can be stored, transported, and used at any time and place. Its producers have no concern as to when and where it will be used; the cost of production is independent of the duration of consumption, and what costs so much a gallon to produce may fairly be taxed by the gallon. With minor reservations, however, electrical energy must be produced as it is consumed, and costs depend essentially on the rate of consumption at a given moment within the restricted area supplied by the generating station. Much capital is locked up in equipment which is idle, but still a source of expense, during the greater part of each day, and on top of these (normal) unfavourable conditions there are the scarcity of liquid capital and the dearness of credit to make the present position of Russian central stations particularly unenviable.

Taking all these facts into consideration, the Société Impériale Technique has urged the Government to consider that the total possible revenue from taxation of lighting current is relatively unimportant, but that if its imposition be regarded essential:—(1) Its amount should in no case exceed 10 per cent. of the normal price of energy; (2) discrimination should be made between different classes of lighting; (3) all possible steps should be taken to avert decrease in present consumption, and as little check as possible should be placed on development. In the last-named connection reduced taxation is considered essential in small communities where electrical energy is still little employed, but where its healthy development is of national importance.

The Société, therefore, proposes the following interesting scheme: In capital cities, assuming average prices of 1¼d., 2½d. and 5d. per unit for lighting street, works and other buildings respectively, the tax to be 10 per cent., *i.e.*, 0·125d., 0·25d., and 0·5d. per unit respectively. In smaller communities, to allow for the fact that generating costs are inversely proportional to population, whilst the "solvency" of consumers is directly proportional thereto, the tax should be adjusted in accordance with population, and should be:—

8 % on the price of energy in towns with ...	Over 100,000 inhabitants.
6 % " " " ...	Between 40 and 100,000 "
5 % " " " ...	" 25 " 40,000 "
4 % " " " ...	Less than 25,000 "

These proposals, which do at least make as reasonable as possible a scheme of taxation for which little can justly be claimed, seem likely to yield quite as much revenue, while causing far less dangerous disturbance to industry than the Government's proposal to levy a 30 per cent. tax on all electrical consumption. Such an impost would certainly be disastrous, and would have far-reaching effects, not only on Russian electrical development itself, but also on the many British interests associated with the latter.

Apart from the fact that taxation on any means of lighting is inherently objectionable, whilst that on energy for industrial purposes is obviously yet more short-sighted, there are plenty of minor matters for contention. Presumably, meters will have to be installed on all consumers' premises, even where private generation is practised, and it is said that the authorities have no great faith in meters, though their distrust is, of course, unfounded, for the ½ per cent. or so error in a good modern meter involves only about ⅛d. in the £ on the energy bill, and the advantage may lie with, as often as against, the State. Then, again, there is a strong body of feeling against taxing any current used to safeguard industrial security, to improve workmen's dwellings, or in philanthropic institutions or hospitals—and these very commendable reservations naturally pare down the possible revenue very considerably. It seems hardly possible that more than £300,000 or £400,000 a year could be levied on the basis of a pre-war consumption, and under existing circumstances, and allowing for exemptions and the throttling effect of the tax itself, probably the returns would be much smaller. Surely any attempt to tax electricity is thoroughly bad business—the possible returns are so small and the undoubted objections so great.

On top of the difficulties with which they are threatened by taxation, Russian central stations have had to contend with great shortage in fuel supply. For many months it has been impracticable to deliver English coal as usual to Petrograd, Moscow and other centres, and the shortage of railways and rolling stock, aggravated by extreme military congestion, has made it most difficult to distribute coal from native mines, particularly from the Donetz district. The central stations of Petrograd, which generally use Cardiff coal and were kept supplied for a time, contemplate a return to naphtha firing. The latter was first adopted in 1901-2, when liquid fuel cost only 36s. a ton, but it was later abandoned owing to abnormal rises in the petroleum market. Though the crisis is said to be so acute that it may be necessary to suspend the working of the electric tramways, there is good reason to suppose that these conditions are quite temporary. The opening of the Dardanelles, which we all hope to see accomplished in the near future, would at once ease the situation and immeasurably improve the industrial position of Russia. Were reversion to be made to oil firing in Petrograd and other stations, it does not seem likely that existing transport difficulties would be overcome or that the use of liquid fuel could be continued once the present crisis had passed. The more serious problem, and the one which will have enduring influence on Russian station development and so on the whole course of industrial expansion, is that of taxing electrical energy. Bearing all facts in mind, it is hard to believe that the game could possibly be worth the candle, but if the tax is to be imposed let us hope—if only for selfish reasons—that it will be on a conservative basis and be removed at the earliest opportunity.

The Wire-Drawing Industries.

The pressure which has existed in the wire-drawing industries during the past 12 months has not eased perceptibly during the present month. The Government demands continue to tax heavily the resources of the works throughout the country, while a fairly large proportion of the private consumers' requirements are being supplied by American wire-drawing manufacturers direct, and in some cases indirectly through British agencies.

There is little doubt that the American wire-drawing firms are benefiting considerably from the stoppage of German supplies into this country, and the extra demands consequent upon the requirements for war purposes. Provided that no artificial restrictions are experienced in the copper market in the near future, a continuance of such satisfactory results may be reasonably looked for in America for some time to come.

As a result of the more efficient system under which recruiting is being conducted at the present time, intending recruits who are skilled in any branch of munition work are not accepted for service at the Front so readily as in the past, but are persuaded, usually without the necessity of authoritative pressure, to return to their duties in the workshop. This improvement in the recruiting system should soon produce a decidedly beneficial effect in the wire-drawing works, where so much disorganisation has been caused by enlistments in the Army and Navy.

Rubber.

A FAINT but welcome glimmer of hope has set in in the rubber market, where indications of a reviving demand have stayed the drooping tendency of prices. The market has been quite firm on the whole, and the variations in value have been of little moment. Dealings in both spot and forward positions have shown more animation and the demand for America has been a prominent feature. The August statistics show an increase in the warehouse stocks of plantation rubber of over 1,200 tons, totalling 6,985 tons, as compared with 5,744 tons in August of last year, while the arrivals during the month were 4,903 tons against deliveries of 4,614 tons. The rubber yield of the Amazon Basin showed a diminution during the year ended June 30th, 1915, as compared with the previous year, the total entries being 35,305 tons, against 39,115 tons in 1913-14, a decrease of 9·7 per cent., which was almost entirely accounted for by the very market diminution of the output of caucho from all sources, the production of this grade alone falling short of that of the preceding crop to the extent of 3,821 tons. The Amazon crop for 1915-16 is estimated at fully 37,000 tons, or about 5 per cent. in excess of that of the crop year just ended, this figure allowing for an increase of, approximately, 10 per cent. of up-river and 5 per cent. of islands, and a further increase of 15 per cent. in caucho. An important element in the production of rubber in the present crop year is a considerable increase of skilled labour available in the Amazon Basin and the development of the cultivation of food-stuffs in the rubber district, and the more economical methods of business in the local markets all justify hopes of a considerable improvement in the exports of plantation rubber. The exports of rubber from the Federated Malay States during August amounted to 3,796 tons, as compared with 3,687 tons in July last, and 1,850 tons in the corresponding month of last year. The following table shows the export month by month for three years :—

	1913.	1914.	1915.
	Tons.	Tons.	Tons.
January	2,131	2,542	3,473
February	1,757	2,364	3,411
March	1,737	2,418	3,418
April	1,626	2,151	2,777
May	1,225	2,069	2,708
June	2,005	2,306	3,403
July	1,781	2,971	3,687
August...	2,363	1,850	3,796
Total	14,625	18,671	26,673

Co-operation between Engineers and Contractors.

TWO papers dealing with co-operation between central stations, contractors, and dealers in electrical supplies have been read recently before the California Association of Electrical Contractors and Dealers, respectively by Mr. S. V. Walton, manager of the commercial department of the Pacific Gas and Electric Co., and Mr. W. L. Goodwin, vice-president and general sales manager for the Pacific States Electric Co.

Mr. Walton prefaces his remarks with the truism that "Co-operation in order to amount to anything must directly benefit the co-operators, and before one would-be co-operator can benefit another he must know him and know something about his problems."

Some of the attempts which have been made in the past to arrive at some working co-operative system have failed, possibly because of a lack of confidence between the parties, and Mr. Walton points out that it is essential to success that "there shall be a fairly good understanding of each other's problems, a feeling of confidence on the part of each that the other intends to play the game fairly with all the cards on the table, and that there should be mutual desire to work harmoniously together, each respecting the interests of the other. Only in this way can the interests of both parties be best served, and the industry as a whole benefited." He observes that from the by-laws of the California Association it is evident that the Association believes in such a policy. One of the by-laws reads as follows :—

It is fully recognised that the economic and proper channel of distribution of electrical supplies is through the electrical supply jobber to the dealer and contractor, who in turn serves the consumer. The dealer and contractor is the natural channel for distributing various electrical devices to the consuming public.

The recognition of the principle embodied in these by-laws is a cause for which the British Electrical Contractors' Association has struggled for many years, and it has succeeded to some extent in securing the co-operation of electrical manufacturers.

The contractors have not, however, been quite so fortunate in dealing with the supply authorities, and, to judge from the papers read before the California Association, the American contractors have been equally unsuccessful, as will be seen from the following quotations from Mr. Goodwin's paper :—

We have had very little encouragement from the central stations generally, and, to my mind, the central station is the one branch of the industry which controls the entire situation. . . . In many sections of the country the central station management assume the attitude that they alone are concerned in the success of the industry . . . and, as the result, a most demoralised position presents itself in such localities. . . . The policy on the part of the central station has been such as would offer no encouragement to either contractor or dealer. The insane desire to increase their load has been at the cost of almost every other branch of the industry. Unless the central station management recognises that the business of the contractor and dealer is just as legitimate as his own, and that they should both work together for each other's interest, antagonism on the part of each is bound to result.

We think that the above quotations, which represent the attitude of many of the American supply authorities, very nearly represent the attitude of a section of the supply industry in this country also.

There is, however, another side to the question, namely, that central station managers are not going to sit quietly in their offices waiting for the load to build up, if the contractors are not playing their part in getting all the custom that it is possible to obtain. It should be quite possible for the two sections of the industry to co-operate to their mutual benefit, but this cannot be done without first establishing mutual confidence.

Lighting of Factories.

THE Departmental Committee appointed by the Home Office to investigate this question has been a long time at work, having been constituted more than 2½ years ago; but it must be admitted that the subject was one of extreme difficulty and complexity, and we are not disposed to reproach the Committee on the score of undue delay. On the contrary, we think it has followed a wise course in publishing the results which have already been obtained, without waiting for the completion of the inquiry, which may not be reached for years to come, in view of the conditions that now prevail.

There can be few questions that present a wider range of variable quantities to be taken into consideration than that with which the Committee was concerned, and the endeavour to arrive at definite concrete conclusions must at times have proved almost disheartening. Every workshop presents a set of conditions nowhere else precisely paralleled; natural illumination varies from morning to evening, and sometimes from minute to minute, over an extraordinarily wide range, and is subject to a variety of modifying circumstances, while to the vagaries of artificial lighting there is absolutely no limit; fortunately, the wonderful power of accommodation of the human eye enables it to adapt itself so as to neutralise these variations to a very great extent, and the Committee concluded that in the meantime it might confine its work to the definition of the lower limit of illumination beyond which the eye could not be expected to fulfil its functions satisfactorily. We are pleased to note that the average practice is already far in advance of the statutory minima suggested by the Committee, and the latter will, therefore, affect only the bad cases.

The importance of good lighting has been abundantly emphasised in our pages, on the score not only of prevention of accident, but also of economy and efficiency, and we commend the report to our readers as being worthy of the closest study; the appendices contain a mass of information, much of which is entirely new, and which ought to be in the hands of every engineer and contractor concerned with electric lighting.

A SIMPLE STERILISING EQUIPMENT.

The sterilising power of ultra-violet rays has been long established, and the only novelty in the equipment sketched in the accompanying figures lies in the simplicity and effectiveness of the means by which water is made to flow in a very thin sheet across a zone of intense ultra-violet radiation immediately before it is drawn off for use. The arrangement is due to Mons. Billon-Daguerre, and was described a short time ago before the Académie des Sciences. The simplicity and effectiveness of the apparatus are such that it should be very useful for military purposes, the sterilising tank being mounted on a motor-car, the engine of which drives a dynamo feeding the lamp whilst sterilisation is in progress. Besides this important special application, the equipment is applicable to any other case where pure water is required.

Instead of drawing water off indiscriminately from a tank full of more or less completely sterilised liquid, a Tee-shaped outlet pipe P, fig. 1, is used. This is of pure transparent quartz, and has a horizontal window or slot W, so that

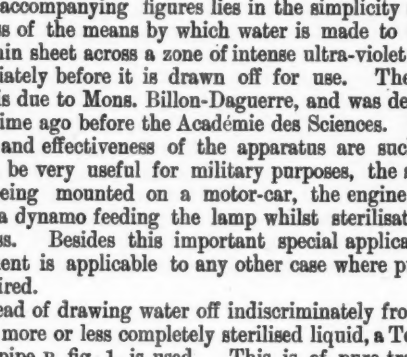


Fig. 1.—Details of Steriliser.

liquid drawn off at O has to pass in a thin sheet over the surface of a mercury vapour lamp L, and is thus subjected to maximum ultra-violet action. To deal with large quantities of water, say, 1,000 to 2,500 gallons per hour, the intake of the outlet piece is provided with a slot on each side, and two quartz-mercury lamps are used as shown

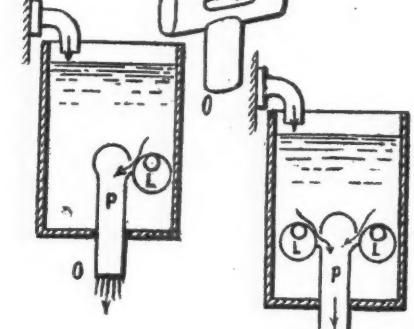


Fig. 2.—Method of Testing the Apparatus.

to the right of fig. 1. These lamps may consume about 4 amperes and be used in series on a 100-110-volt circuit (the actual lamp P.D. being about 43 volts each). The gross energy consumption thus works out at about 0·2 KW.-hour per 1,000 gallons sterilised, and the cost of treatment is negligibly small.

Severe tests have been carried out on this apparatus, taking water from the Seine below Paris, passing it up through a sand filter in a tank B, fig. 2, and mixing it in a tank O, with a culture from an auxiliary tank G containing bacillus coli, cholera vibrio, tuberculosis germs and various ferments. This frightful mixture left the tank E perfectly sterilised at the rate of 2,200 gallons per hour with a power consumption of 440 watts. After 3,000 hours' continuous operation there was no appreciable reduction in the germicidal efficiency of the lamps, and no calcareous or other deposits had formed on either the lamps or the outlet pipe (no doubt owing to the scouring effect of the rapid water flow). The economy of the process and the simplicity of the equipment are remarkable.

LIGHTING IN FACTORIES AND WORKSHOPS.

The Committee appointed by the Home Office in 1913, to inquire into the conditions necessary for the adequate and suitable lighting (natural and artificial) of factories and workshops, reports* that it has held 38 meetings and examined 50 witnesses, besides obtaining great assistance from Trade Associations representing both employers and operatives, and from H.M. Inspectors of Factories. The inquiry was limited in the first instance to the textile, engineering, and clothing trades, and several tours through industrial parts of the country were undertaken during the winter of 1913-14, 86 works being inspected. Before these visits took place, measurements of illumination were made in many of the workshops, the tests aggregating about 4,000 in number, and relating to 163 rooms in 57 factories; the data thus obtained, together with particulars as to the dimensions of the rooms, sizes of windows, and the number and nature of the light sources installed, have been published in full separately,† together with the notes made by the Committee, and a summary of the results is appended to the report.

A series of experiments was also made in a room set apart for the purpose at the National Physical Laboratory, in which the nature of the lighting and the degree of illumination could be varied at will; details of these experiments are given in an appendix.

As a preliminary step, the Committee draws attention to the important distinction between *illumination* and *surface brightness*, pointing out that the former is measured by the amount of light received on the surface of an object, while the latter is measured by the amount of light returned from the surface, and is always less than the former (unless the body is itself luminous). The difference may be very great, as in the case of a black floor or foundry sand, which returns very little of the incident light. The Committee considers that the only rational criterion of the adequacy of lighting is the actual illumination at the place where work is being carried out, or the floors of passages, &c., and states that the practice of taking as a criterion the candle-power per square foot of floor area is not correct; nevertheless, as will be seen later, this is the method which it adopts in its present recommendations.

The Committee summarises the factors in good lighting as follows :—

(*a*) Adequacy.

(*b*) A reasonable degree of constancy and uniformity of illumination over the necessary area of work.

(*c*) The placing or shading of sources so that the light from them does not fall directly on the eye of an operative when engaged in his work, or when looking horizontally across the workroom.

(*d*) The placing of lights so as to avoid the casting of extraneous shadows on the work.

While all these factors are of great importance, and should receive special attention in the design of lighting installations, the Committee confines its attention in the present report almost entirely to the adequacy of the illumination.

There are at present no general provisions in the Factory Acts of the United Kingdom with regard to lighting,

* First Report of the Departmental Committee on Lighting in Factories and Workshops, Vol. I, (cd. 8,000) of Session 1915.

† Results of Observations of Illumination in Factories (Stationery Office Publication).

although heating and ventilation have been dealt with; on the other hand, the codes of all the chief European countries, the United States, and India contain such regulations, which are summarised in an appendix to the report.

The present lighting of factories is next discussed under the heads of natural and artificial lighting. In the case of the former, roof lighting is obviously the best, and it is stated that the illumination thus obtained with a good system is very uniform, and may be from 2 to 10 per cent. of the outdoor illumination. In many cases, however, lateral illumination only can be provided, and in the case of wide rooms may be inadequate in places, while it is far from uniform. Unsatisfactory illumination is also met with in the case of old and unsuitable buildings which have been converted into workshops, and where the light is obstructed by external or internal means; whitewashing the walls of adjoining buildings or the adoption of special reflectors, &c., to some extent rectifies the trouble, and in some cases much can be done to improve the lighting by taking care that articles are not stored near the windows. Dirty windows, walls, and ceilings are frequently met with, and these causes of inadequacy of illumination can generally be remedied at a minimum of expense.

Where daylight is insufficient, it may be supplemented by artificial light, but there is a consensus of opinion amongst the witnesses, with which the Committee concurs, that conditions entailing the continuous use of artificial light are unnatural and entail greater strain on the workers. There are many devices by which additional daylight can be secured, and in overshadowed rooms the fullest use ought to be made of these. There are no easy means of solving the question what is the minimum amount of daylight in which operatives should be allowed to work continuously; the ordinary conventions, in terms of the ratio of window area to floor space, fail to take all the conditions into account, and a standard in terms of foot-candles would be unsuitable.

With regard to artificial lighting, the chief causes of unsatisfactory illumination include the provision of too few or too weak light sources, the use of antiquated systems of lighting (which are also extremely uneconomical), inadequate supply of gas or electricity at times of maximum consumption, neglect of upkeep, obstruction (as, for instance, where the sources are situated over travelling cranes, which, however, in some cases carry lamps travelling with them), and shadows cast by the source being improperly situated.

The effects of unsatisfactory illumination in causing accidents, and injury to eyesight and health, have been investigated, and it has been found that the percentage of accidents due to persons falling is higher in winter than in summer; in addition, the proportion of accidents is far higher with artificial than with natural lighting. Little evidence of injury to eyesight or health has been obtained. The lack of good lighting, however, is responsible for the accumulation of dirt and the encouragement of idling, and the effect of improved lighting on the quantity and quality of the work, as well as the earning power of the workers, has been shown to be very marked.

Reviewing the evidence, the Committee finds that there is a general agreement as to the economic and hygienic advantages of adequate and suitable illumination, and points to the great improvement in industrial lighting which has taken place in recent years in support of this opinion; in the designing of modern factories good lighting is now regarded as one of the most important factors contributing to industrial efficiency.

The visits paid to factories have enabled the Committee to realise the contrast between the depressing effect of dark surroundings and the cheerfulness of a brightly illuminated workroom, and the vast difference in the working lives of the operatives that must result from continual employment under the respective conditions. The necessity of prescribing adequate lighting in factories and workshops has long been recognised abroad, and the Committee feels that while it is difficult to define standards, it is justified in recommending that a requirement in general terms be applied to all factories and workshops. Standards can be laid down only when the special conditions of each industry have been inquired into, and therefore if standards are to be established, the Secretary of State should have power to prescribe them by order.

The Committee therefore recommends that:—

1. There should be a statutory provision:—

(*a*) Requiring adequate and suitable lighting in general terms in every part of a factory or workshop, and

(*b*) Giving power to the Secretary of State to make orders defining adequate and suitable illumination for factories and workshops or for any parts thereof or for any processes carried on therein.

It is necessary to indicate more precisely what is conveyed by the term "adequate lighting." Broadly, the illumination may be said to be adequate and suitable provided that:—

(i) It is sufficient for the proper carrying out of the work both as regards quality and output, and

(ii) There are no lighting conditions prejudicial to the health, comfort and safety of workers.

In order to satisfy these requirements, the illumination should comply with the requirements tabulated on the previous page. Special emphasis is placed upon the avoidance of "glare," of excessive contrast, and flickering lights.

The next question is the desirability of specifying the amount of illumination implied in the terms "adequate and suitable." Owing to the great progress that has recently been made in the appliances for measuring illumination, it is now practicable to specify numerical values in a manner that would hardly have been possible some years ago.

It is therefore proposed to specify the minimum intensity of illumination desirable, from the standpoint of general convenience and safety, in parts of the workshops where work is normally carried on, and in yards, passages and open spaces along which people are ordinarily liable to pass.

Though the intensity of the light at the working plane is the most important factor of adequacy and suitability, it is by no means the only one to be considered; each trade, or even each process, must be considered on its merits, and this has not yet been done. The Committee therefore deals only with the more general illumination of the factory or workshops as a whole, under three heads:—

(*a*) The illumination of workrooms or parts of workrooms where work is in progress, that is, of the *working area* of the factory.

(*b*) The illumination of passages, stairways, &c., and places in factory premises over which persons are liable to pass, but which are not parts of *working areas*; and

(*c*) The illumination of open yards and approaches.

The following four recommendations are made under these heads:—

2. Over the "working areas" of workrooms the illumination measured on a horizontal plane at floor level shall not be less than 0·25 foot-candle, without prejudice to the illumination required for the work itself.

3. In all parts of foundries in which work is carried on or over which any person is ordinarily liable to pass, the illumination measured on a horizontal plane at floor level shall not be less than 0·4 foot-candle.

4. In all parts of factories and workshops (not included under recommendation 2) over which persons employed are liable to pass the illumination measured on a horizontal plane at floor level shall not be less than 0·1 foot-candle.

5. In all open places in which persons are employed during the period between one hour after sunset and one hour before sunrise, and in any dangerous parts of the regular road or way over a yard or other space forming the approach to any place of work, the illumination on a horizontal plane at ground level shall not be less than 0·05 foot-candle.

These values are suggested without prejudice to the special illumination required for the carrying out of the work, which naturally varies greatly according to the nature of the operations.

In order to meet exceptional circumstances in which the standards proposed in Recommendations 2-5 might cause hardship, in Recommendation (6), provision is made for exemption of individual cases, and of factories to which the above requirements could not be applied, and the case of shipbuilding yards is to receive separate consideration. Finally, in Recommendation (7), suggestions are made for the periodical cleaning of windows. In conclusion, the Com-

mittee points out that the minimum values prescribed are considerably lower than those proposed by many witnesses and are also lower than those found to exist in the majority of factories visited. In many cases manufacturers would naturally prefer to provide a substantially higher value than that indicated. The intention has been to propose values which can be adopted as a practical legal minimum without causing hardship, and would serve the purpose of raising the level of illumination in those factories which are behind modern practice, in regard to methods of illumination. In view of the diversity which always exists whatever the system of lighting, any minimum value will usually connote a very much higher maximum and average, and with a given minimum the efficiency of the illumination depends to a large extent on this diversity. In the great majority of factories the standards of general lighting suggested would be inadequate for the actual machines and work-benches, and local lighting in addition is generally essential.

The Committee did not feel justified in drawing any distinction between direct, indirect and semi-indirect lighting, nor between systems which differ in the colour composition of the light. Similarly the standards are intended to apply equally to natural and artificial lighting; that is to say, when the natural illumination falls below the prescribed limits, it must be supplemented or replaced by artificial illumination.

The data given in the appendices will be of service to those engaged in designing new factories and in examining the adequacy of lighting in existing buildings. At present there are few collated data of this character available, and the desire not to withhold them longer from publication is a further reason for the submission of a preliminary report at this stage.

Adequate artificial lighting is an important matter in the utilisation of factories for night work, and a close connection appears to exist between the lighting conditions and the quality and output of work. The information contained in the report should, therefore, be of special interest at the present moment, when many factories are working overtime, and preparations are being made for the period of the year when artificial lighting is mainly required.

The appendices, which constitute the bulk of the volume, contain a great store of information, most of which is of a character hitherto unobtainable. Amongst the "processes requiring exceptionally good light" on account of fineness of the work, are included letterpress printing, machine and fitting-shop processes, and the manufacture of scientific apparatus and glow lamps; and for the avoidance of accidents, power-press processes and iron foundries. Processes involving exceptional exposure to glare include electric welding (causing "welders' rash," an affection similar to "snow blindness"), electric glow lamp sealing and testing, carbide of calcium furnaces, the generation of electricity and testing of electrical apparatus, and various processes in which the position of the light source is unfavourable. Workshops in which the lighting is often inadequate include smiths' shops in engineering works, foundries, metal stamping works, and sawmills. A variety of special means of lighting employed in particular processes, such as white reflecting surfaces, white tissue paper to diffuse the light, &c., is tabulated.

The experiments made at the National Physical Laboratory led to some very interesting results; work-people—mainly seamstresses—were employed under a variety of conditions, and the degree and kind of illumination which they found satisfactory were ascertained. For work on white stuff, 1¼ ft.-candles was sufficient, but for purple 2 ft.-candles was necessary, and when working on black materials not less than 4 ft.-candles sufficed, while five to six was necessary for comfort. These figures were obtained with direct lighting; tests were also made with indirect lighting, and in every case it was found that an increase of 40 per cent. or more in the illumination was required to give the same degree of comfort in working. Further experiments on this point showed that the visibility of fine detail depended upon the variation of the surface brightness over the raised portions of the pattern due to changes in the angle which such surfaces made with the direction of the incident light, and upon the shadows cast on the background by the raised portions of the pattern. Both of these effects depend upon whether the light comes from a single direction or from a number of widely different directions. In the case of direct lighting, while the coefficient of reflection of the surfaces tested varied from 80 to 3½ per cent., the surface brightness which gave a standard degree of visibility of detail remained almost constant between the limits 0·027 and 0·033 ft.-candle, the average being about 0·030. When experiments were made on samples of calico, dyed from very light to very dark blue, it was found that the illumination had to be increased from 1·4 to 12 ft.-candles, while the surface brightness ranged only between 0·62 and 0·9 ft.-candle, with an average of 0·73, in the case of one observer, the values being somewhat lower in the case of another.

The Committee concluded that for equal visibility there must be constant surface brightness; the visibility of detail depends upon the unidirectional character of the light; and work such as sewing on the darkest materials requires not more than 5 to 6 ft.-candles (direct lighting).

A long appendix is devoted to the summary of data obtained from observations of daylight and artificial illumination in factories. The floor illumination by artificial light was found to range about equally above and below 0·4 ft.-candles in foundries, 0·6 in engineering shops, 0·4 in weaving sheds, and 0·6 in spinning mills. The illumination on the work in engineering shops was very variable, but tended towards middle values of 1·6 ft.-candles for machine work, 1·85 ft.-candles for bench work, and 1·0 ft.-candle for heavy work.

THE BRITISH ASSOCIATION—II.

The British Association meeting in Manchester, the opening stages of which were reported in our last issue, continued until Saturday last. The meeting was shorter than usual on account of the war, and, as was only to be expected at a time like this, the titanic conflict now waging in Europe affected the proceedings in quite a number of ways. The attendance of members was down substantially, although it was greater than appeared likely at one time. Many persons known by name and by repute were absent, some being engaged on war work of various sorts either in this country, in Flanders, or at Gallipoli. References to the effect of the war on the Association's activities were frequent, both in the addresses of the presidents of Sections and in the papers and discussions; there were no social functions; and, lastly, one noted here and there that a khaki-clad officer would hurry into a Section, have his say, and hasten away to important work vastly different to that in progress in the Manchester University.

The address of Dr. H. S. Hele-Shaw, the president of Section G (Engineering), an abstract of which is given in our columns, was delivered in characteristically breezy fashion, and the author broke away from time to time to stress important points. In one place, for example, he remarked with some force that he did not believe that things would go back after the war, as had been stated at the Trade Union Congress then sitting. "Let us go back with what is good," said the President. "Why should we turn women out after the war when they are showing themselves splendidly capable of taking their part in many industries? We shall want all we can get." The applause that met the statement was indicative of the agreement of the listeners.

In calling on Professors Asakawa and Petavel to give their paper on "Investigations of the Thermal Efficiency of a Gas Engine," the President made a self-congratulatory reference to the fact that he had finished his address very punctually—on the stroke

of noon, when the first paper was timed to be given. The observation caused amusement, but no discomfiture to Dr. Hele-Shaw—not even when he was informed that the clock was really forty minutes late! The clock, by the way, did not show its face at subsequent sessions. A kindly janitor had pasted a sheet of paper over it.

After Professors Asakawa and Petavel's paper, a Report on Gaseous Explosions was read, and was followed by Professor Thornton's paper on the "Total Radiation from a Gaseous Explosion."

In the afternoon the members of the Section visited the premises of the Manchester Steam Users' Association, where Mr. C. E. Stromeyer, chief engineer to the Association, showed a machine for determining fatigue limits calorimetrically. The stresses are produced by revolving masses.

In Section F (Economic Science and Statistics) the whole day was devoted to a discussion on means for the promotion of industrial harmony. There was a large attendance, and speakers followed each other with great rapidity, and with much eagerness to help forward the consideration of this extremely important subject.

The proceedings of Section B (Chemistry) were chiefly interesting for the presidential address of Professor W. A. Bone, F.R.S., who dealt with the important subject of fuel economy. Dr. H. J. Sand gave an experimental demonstration of a new cadmium vapour electric arc lamp.

Thursday was almost entirely a "Manchester Day" in Section G, a number of important Manchester municipal undertakings being described.

Mr. S. L. Pearce, the city electrical engineer, spoke on the Electricity Undertaking and the projected Barton Station. The information he gave was on the same lines as that given recently in a special article on the Barton scheme which appeared in the Electrical Review. Not the least interesting point mentioned was that the Ship Canal Company had withheld their sanction to use water from the Canal for condensing purposes, and that the new station would use the sewage and sub-soil water—in the form of a purified effluent—which passed down the main outfall sewers to the Corporation's sewage works at Davyhulme, situated about 1,400 yd. from the Barton site. It was found that the use of this water would really be most helpful to the sewage department.

The work of the mechanical engineering department of the Municipal School of Technology was outlined by Professor A. B. Field; and Mr. J. B. Newbigging, the city gas engineer, delivered a paper on the recent work of his department.

The Section concluded the day's sitting with a paper by Mr. E. C. Mills on a unit gas producer for steam boilers.

Papers on smoke and its prevention—nine in number—were given in Section B. Mr. E. D. Simon outlined the lines of research in smoke abatement, and spoke of the work of the Manchester Air Pollution Advisory Board, which aims at securing the purification of the atmosphere by research and propaganda, as opposed to the older method of prosecution, and has an annual grant from the Corporation of £450. He said the estimated damage done by smoke in Manchester and Salford was nearly a million sterling per annum. Some reduction of factory smoke had been effected, and domestic smoke provided the main field for work at present. The last paper of the series was entitled "Electrical Precipitation of Smoke," but the proceedings had been long-drawn out, and Mr. W. W. Haldane Gee, the author, could do no more than throw two slides on the screen and refer the audience to the Proceedings of the American Institute of Electrical Engineers (April, 1915) for details. (See also the Electrical Review of May 14th, 1915.)

In the course of the discussion Mr. Arnold Lupton mentioned that when he was living in Leeds he estimated that the cost of the smoke nuisance to him in the house he was living in was equal to a rate of 6s. in the £ on the rateable value, and he computed that smoke could be prevented by an expenditure equivalent to a rate of 1s. in the £.

Mr. W. Reid (London) thought that some people connected with gas overstated the case enormously. There were huge areas of workmen's dwellings, and it was no use going there and telling the people to put in gas stoves because they would lead to a great saving of labour. In houses of that kind there was practically no labour to save. He also mentioned that he had just had occasion to see to a new office in an old building in connection with a business he was interested in, and he made inquiries as to the cost of having gas put in. He found that the cost of putting in gas alone, before he consumed a single cubic foot, was one and a half times as much as the cost of the coal for the whole year.

The Section passed a resolution in favour of a suggestion that a committee should be formed to consider questions relating to prevention of smoke, fuel economy, and so forth, with a view to the preparation of recommendations.

"Outlets for Labour after the War" was the subject considered by Section F (Economics), and it was divided into three main heads. In the first place, attention was devoted to a report prepared by a conference called by the Section to investigate the replacement of male by female labour in consequence of the war. Secondly, Major Tudor Craig dealt with the question of employment for disbanded members of H.M. Forces; and, thirdly, Mr. C. Turnor discussed land settlement for ex-service men.

Economics and the War.

The circumstance of war has given to the Economic Science Section as great an opportunity as any Section has had this year. The vast upheaval that the terrible events of the past thirteen months have occasioned; the wastage of life and treasure; the industrial bearing of the war both in regard to the production of munitions to assist the Forces and in regard to the conduct of industry after the war; these have brought before all our minds problems of the utmost importance. Our settlement of many of the difficulties that have presented themselves has of necessity been the action of a people living "a day at a time." Everything of the kind is, more or less, temporary, and designed for the purposes of the moment. Many of the questions will have to be considered and re-considered probably time and time again in the years that are coming, but it was most appropriate that this Section should devote itself almost exclusively to some of these matters this year. We require no extraordinary gift of imagination and foresight to be able safely to prophesy that the proceedings of the Section will be equally, if not more, important next year, and the year after, and perhaps the year after that. In the past the proceedings of the Section have not greatly concerned us in these pages, but that is not so to-day when everybody interested in our national industrial life is confronted with such problems as we have indicated above. "Not the least dominant phase of this epoch-making struggle is the economic one," said Prof. W. R. Scott, the president of the Section, in the opening sentences of an address devoted to consideration of "some of the reactions of this great war upon industry, credit and finance." It is recognised by him in the course of his remarks that "the two most critical periods occasioned by war are, first, the change from peace organisation to war organisation, and secondly, the converse change after the conclusion of hostilities on a large scale." Space prevents us at the moment from quoting fully Prof. Scott's references to the manner in which specialised labour and capital were transferred from one process to an-

other, but we quote his reference in regard to what is to follow:—

All this is satisfactory for the war period; it must be remembered that on the return of peace the reverse change will have to be made. There may be a short trade boom (arising out of the attempt to restore some of the material ravages of war), but the joint demand from it and from the trades reopened is likely to be considerably less than the huge present expenditure on manufactures for war. Thus the unemployment occasioned by dislocation of industry through hostilities is likely to be carried forward as a species of suspense account which must be liquidated not very long after peace. Moreover, international credit is likely to re-act on the situation in a prejudicial manner. Even already the financial system of Germany is more strained than appears on the surface. The fact is advantageous to us as belligerents, but it will probably be prejudicial to us not long after the re-establishment of peace. At present much of the inconvertible paper circulating on the Continent does not affect us here. When the inflation has to be squeezed out after the war, a disturbance of credit is not unlikely.

Prof. Scott concluded his very interesting address as follows:—

A special aspect of the problems under discussion is the provision of capital for the re-starting of trades contracted by the war and for the restoration of Belgium and other regions desolated during the progress of hostilities. Chalmers, writing a hundred years ago, supposed that in cases of this kind "in a very few years the recovery both of population and labour would be completed." The explanation he gave was far from satisfactory even for the time at which it was written, and it is still more deficient as applied to the present circumstances, when in industrial countries fixed capital is much more important than in Chalmers's day. In the last quarter of a century any great catastrophe, such, for instance, as the partial destruction of San Francisco by earthquake and fire, has been repaired with comparative ease by bringing capital from outside. But the waste of war renders capital exceedingly scarce; in fact, a famine of capital after the war has been predicted. Such an anticipation is over-pessimistic, but capital is likely to be obtainable for a time only with some difficulty. It is to be feared that after the war Europe will experience very considerable straits for several years to come. Not only must the waste of war be made good, but its evil legacy in inflated funded and floating debts must be gradually dealt with, lessening by reason of increased taxation the normal margin for new savings. Increased work and greater economy are the only remedies, aided by improved methods of production.

"It is to be hoped that some of the inevitable loss will be repaired in time by better methods of organisation and by an accelerated rate of invention. The waging of a just war results in a quickening of the national spirit. It forces a nation out of the easy and well-worn paths of custom and convention. Thus, out of all the suffering and all the loss, some good will come. The large proportion of our young manhood, which has gone to serve the country on the seas or in the field, and which returns having looked death in the face without being afraid, will not take up life where it was left. The noble qualities that have been evoked by the stress of battle will remain and will influence civil life during the next generation. The outlook will be both broader and also more simple. Methods of social legislation and administration will become more direct and less timorous. The men who have dared greatly and who have endured will chafe against the rules that have been formed during easier times. Great wars tear away the veils which hide the essential needs of living, and reveal what is fundamental. The directness of vision that has faced danger is not likely to be alarmed in facing the difficulties of our social and industrial problems. And so we may expect with confidence that our legislation will be bolder and also more sane than it has been in the past. The sacrifices of so many cannot pass, when the war is over, and leave no trace. The nation has been re-vitalised in the course of the struggle and the influence of this movement will persist.

"In many respects the economic problems that will confront us after the war will be even more serious, and certainly not less difficult. than those of the present time. Still, there can be no doubt that these will be faced with courage and patience. The period of stress through which we are passing has shown the unity of thought and purpose throughout the whole Empire. And this, in spite of many appearances to the contrary, will be a great asset in the future. The great national emergency has caused a closing of the nation's ranks, and it rests with us to keep them firm and steadfast when peace returns. There are plain signs that it may not always be easy, since so many industrial and other difficulties have been carried forward as a suspense account which is to be dealt with when the war is over. National unity is enabling us to progress towards victory, and the same unity will be required to enable us to reap the full fruits of that victory at home. It will be a mad waste not to employ the qualities of heart and mind which have been aroused in this great struggle in the service of peace and social progress. The future may be difficult for some years to come, but difficulties are the opportunities of the strong and courageous. It has fallen to us to live in an heroic age; and, if we remain true to ourselves and to our high destiny, we shall have the strength and fixity of purpose to achieve greatly in peace as well as in war."

Industrial Harmony.

After Prof. Scott had finished reading his address the Section devoted the rest of the proceedings for the day to a discussion on "Means for the Promotion of Industrial Harmony."

Prof. A. W. Kirkaldy (Birmingham), opening the discussion, said it might be that an outcome of that meeting would be the formation of a small, but competent and representative, committee to accumulate and dispassionately study the whole industrial situation and endeavour to agree on broad lines on a policy to secure the establishment of harmonious co-operation of all sections of the industrial army. The last twelve months had cast a lurid light over what friction gone mad could accomplish, and they needed to realise very clearly that friction gone mad in the industrial world might well produce greater calamities and suffering than had resulted from the tearing up of a "scrap of paper" in the international sphere. He was convinced from many years' close touch with industrial England that this country was threatened by a danger far greater than that of any other external enemy. Friction had existed in many spheres, but in its most acute and dangerous form it had manifested itself in the industrial sphere. In a remarkable way the war brought about a national harmony for which few had dared to hope. After a year of war there were signs that when once the compelling hand of war was relaxed—and this might come sooner than some people thought—friction in an intensified form might break out in the industrial world. It was this possibility of friction and its causes with which he was concerned. Could they lay aside prejudices dispassionately and calmly estimate the evil and realise its causes? If they could see their way to this they might be able to suggest measures which might minimise resulting harm, and even point the way to harmony instead of friction, and so enable this country to take full advantage of what would probably be a most remarkable economic situation, and thus repair in comparatively short time the loss and ravages incident to this war. There were two points which he believed would be of considerable importance:—

1. Is class war a necessity?
2. What is the truth about profits, dividends, salaries, and wages?

Class warfare had now been taught for so many years that it was in danger of being accepted as an eternal and immutable truth. But was it true, and was it necessary? Those were questions they must answer, and, in answering them, pause to consider the issues entailed. Was it not that industrial strife was really due to ignorance?—and ignorance was as profound among some employers as among some labour men. They had given themselves up as a nation to a love of gain and accumulation rather than the study of progress of economics, which meant the use of what they had in such a way that every member of the community should be able to develop his or her capacities naturally and healthily. The rush to be rich—a very mistaken synonym for happiness and well-being—was a Will o' th' Wisp that had been luring them on to national decadence. The word "economics" did not command their attention and respect, because it had come to connote things that were repugnant to common-sense and their highest interest. But that was not the fault of economics; it was due to the ignorance that existed as to economics and what economics taught. Surely, what was taught on the subject of production should commend itself to the common sense of every thinking man. To obtain the best results one of the first requisities was harmonious co-operation among the factors of production. Friction among these inevitably lessened the amount produced. Whatever tended to decrease production must decrease the real amount received as salaries, wages, dividends, and so on. What seemed to him to be required at the present time was a right judgment over the whole industrial sphere, for what concerned the well-being of the nation was not only that production should be carried on on right lines, and to the fullest extent, but that what was produced should be equitably distributed among those responsible for its production. Nor did those two cover the ground adequately, for not only must commodities or wealth be rightly produced and equitably distributed, but they must be wisely consumed. Thus, the industrial army should have correct knowledge of the production, distribution, and the consumption of the results of its labour. There was a great lack of knowledge among employers and employed on some elementary subjects. Among employers there was too great a desire to obtain wealth for wealth's sake, and on the part of workers to increase wages without stopping to consider how the fund from which profits, dividends, wages, and salaries were drawn was produced; and when wealth and higher wages were obtained there was amongst all classes of the community too great a tendency towards waste and extravagance, without a thought as to one's responsibility to the nation for the right use of one's resources. In this connection, he would like the Section to consider two points:—

1. Did class warfare lead to a diminution of production?
2. Did they take a broad enough view of their economic position?

During the first decade of this century it was estimated that trade disputes lead to the sacrifice of wages to the extent of about £600,000 per annum. Some or all of that loss might

have been justifiable, and that brought him to the last point he wished to discuss there: What was the truth about wages? It used to be thought that wages were paid out of an existing wage fund, and, if that were true, one section of labour could only obtain higher wages at the expense of some other. The mistaken notion was cleared up long ago by a well-known economist who pointed out that wages were paid out of existing wealth, but only for convenience sake. Really, wages were limited by the amount of wealth produced. The more produced the greater must be the wages paid. With decreased production, in the long run there must be decrease in the real wages received. With full knowledge as to the fair share of production that was due to each grade of labour, there should be equitable distribution, and when men were convinced that they were obtaining this fair reward production would be stimulated, for with increased production each man's share might be greater. Could they discover what proportion of the wealth produced annually was the share of each participator in the work of production—could they but establish the proportion due to each factor, the task of the arbitrator in wages disputes would be enormously lightened. What was required was that the whole industrial army should be graded so that the value to the community of the most capable organiser who worked with his brain, guided by experience, might be as accurately known as the value of the artisan, the labourer, the humblest youth employed. Was it possible for some of them to give their attention to that? Could they appoint a representative committee to work at this subject and continue its labours until it had suggestions to make that might be offered for acceptance by the industrial army? If national harmony could be attained in the industrial world there could be no possible doubt as to the future of our Empire.

Sir Chas. W. Macara, Bart., was the next speaker. He said that the relationship between Capital and Labour was a subject of supreme importance at any time, but more especially in a time of national crisis such as we were now passing through. He said that he was one of those who, in the early days of the war, were approached by representatives of the Government regarding the effect the war would have upon industry, and what could be done to minimise the dislocation that was certain to ensue, and to keep the workpeople employed as much as possible. Recognising the colossal task with which the Government was confronted, and that it was essential that the assistance of the most experienced practical men should be taken advantage of, he strongly advocated that all existing organisations of capital and labour, and, indeed, of every kind, should be at once brought into requisition in preference to forming new ones to deal with the crisis. There was ample correspondence to prove, and resolutions had been passed and published showing, that this supremely important matter had been urged on the Government without avail. Everyone who had had experience of such work would realise that the creation of new organisations could not be efficiently carried out without expenditure of much time and labour, whereas it was comparatively easy to adapt existing organisations to deal with great and sudden emergencies—and time was an all-important factor. Having visited many of the principal countries of the world, and having studied their methods of working, he was convinced that, upon the whole, this country was as well organised as any, but the Government had not understood how to utilise existing organisations as they should have done, and in this respect we had been placed at a disadvantage with enemy countries whose Governments, on the outbreak of war, at once utilised all their existing organisations, and deputed to their most experienced industrial and commercial organisers, definite and important duties in connection with the carrying on of the war. Had this been done in England, instead of Ministers keeping matters in their own hands, it was his opinion that we could have faced this great upheaval much more effectively than had been the case. Efficient co-operation of the industrial, commercial, financial, scientific, transport, and labour interests with the Government would have enabled our enormous resources to have been brought into requisition from the very commencement of the war. As it was, after twelve months of war we were only now realising what proper co-ordination of all our vast resources might have accomplished; indeed, the difference, so far as practical results were concerned, between thorough organisation and the reverse could scarcely be comprehended. It was unfortunate that the services of men who had led the great organisations of capital and labour had not been taken advantage of to anything like the extent they should have been. Had this co-operation between the various organisations existed, it might have been possible to have dealt more effectively with the problems connected with the supply of the necessaries of life, which, he pointed out to the Government, would not only constitute the chief difficulty in carrying on the war, but would be the main factor in terminating the struggle. It was useless, however, dwelling upon the errors of the past which could not now be altered, and the only object in referring to them was that in the future full advantage might be taken of the experience gained so that the vast resources of the nation might be utilised to the fullest extent. At the end of his remarks Sir Chas. Macara gave the following summary of his views:—

1. That harmonious relationship between capital and labour is always of the utmost importance, and that at a time of great national crisis it is supremely so.
2. That in order to cope with such a colossal task as that by which the Government was confronted, the task would have been lightened and much would have been gained, had they at once enlisted the assistance of experienced industrial organisers, and co-ordinated all existing organisations.
3. That the United Kingdom is as well organised as any other nation, and had there been effective co-operation of the industrial, commercial, financial, scientific, transport, and labour interests with the Government from the commencement of the war, the position in every respect to-day would have been vastly better than it is.
4. That by the co-ordination of these interests, the problems connected with the supply of the necessaries of life, and with the undue raising of prices of commodities, might have been coped with much more successfully than they have been.
5. That the rise in the prices of commodities has undoubtedly been the main factor in creating industrial unrest.
6. That the only object in calling attention to the errors of the past is that we might profit by the experience gained, and so utilise to the utmost the vast resources at disposal.
7. That the interference by politicians with industrial disputes is to be strongly deprecated, often leading to inconclusive settlements, it being impossible for them to have the necessary knowledge of the intricacies of the different industries or their varied conditions of working; that such interference only engenders bitterness and does ultimate harm.
8. That thorough organisation of both capital and labour is essential to the smooth working of the industries, and that where this is the case, disputes are generally settled by negotiations between the parties themselves.
9. That disputes frequently arise from an exaggerated estimate of the return on capital, and that schemes for ascertaining this return should be promoted, as exaggerated views often lead to unreasonable demands.
10. That the Industrial Council, which was appointed by the Government in 1911, and which is composed of an equal representation of capital and labour, with a non-political chairman, has not been utilised since the outbreak of war, that no adequate explanation of this had been offered, and that the valuable report of its inquiry into industrial agreements has not been made use of.
11. That the enforcement of compulsory arbitration where large bodies of men are concerned is an impossibility, and that an inquiry into the merits of a dispute by experienced men representing capital and labour, and the publicity given to its findings, would, together with public opinion generally, supply the only effective compulsion.
12. That trade union limitation of output is against the best interests of labour.
13. That official representatives of labour are generally men of capacity and fairness, deserving of the confidence of the rank and file.
14. That the effect of the war upon industries has been varied, and that any war bonus or wages advance should only be granted after full investigation by leaders of capital and labour.

He had endeavoured to deal with a complex problem from the standpoint of one who had during the past 20 years been frequently placed in the difficult position of having to preside over conferences of masters and men in connection with disputes, while occupying the position of President of the Masters' Federation during that period. Whatever success might have attended this work was mainly attributable to being able to eliminate personal interests, and to view matters solely from the standpoint of endeavouring to act fairly between man and man. From a wide experience he had come to the conclusion that nothing was gained from strikes and lock-outs; that the leaders of capital and labour had exceptionally heavy responsibilities, and that industrial peace, especially at present, was absolutely essential. Mistakes and the difficulties they caused frequently proved to be blessings in disguise. So far as the British Empire was concerned the greater the difficulties to be faced, the greater was the energy and determination to overcome them. It was fervently to be hoped that such an arousing was now taking place and that everyone was being made to feel the seriousness of the situation, and that all classes must be prepared to take any sacrifices that might be necessary to ensure the speedy and victorious termination of the unprecedented struggle in which we and our Allies were engaged in defence of freedom and civilisation.

(To be concluded.)

Presidential Address to the Engineering Section, by H. S. Hele-Shaw, F.R.S.

(Concluded from page 333.)

Education.—A sign of the times is the inclusion of an education section in an association for the advancement of science. This has not been done on the narrow ground of improving the teaching of science in schools, but because it is now recognised, and this none too soon, that the whole problem of education must be treated in a scientific manner.

When the subject of engineering education is mentioned we are apt to think only of the training of such engineers as have been considered in a recent report issued by the Institution of Civil Engineers, and to exclude, as that report purposely does, the training of our artisans and foremen. We certainly do not connect the idea at all with the training of the artisan himself. As a matter of fact, while high scientific

training of the professional engineer and manufacturer is of vital importance, the proper education of the men whom he will have to control is scarcely less so. The latter education may not be of the same kind, but it is just as vital to the country, and its present condition is a serious evil.

One of the most humiliating things of the present war has been the mutual relation of labour and capital in this country in what is probably the most critical period of our history. I will say more later on this subject, but there is no doubt the subject of industrial education needs earnest consideration. Take the first, the education of the professional man—the class, for instance, joining such institutions as the Civil, Electrical, or Mechanical Engineers; we find in one respect a most satisfactory progress as to what is insisted upon before such men are allowed to join one of these bodies. All such institutions now demand technical diplomas or University degrees, and, in addition, satisfactory evidence of practical training. But to prevent injustice to the man who may be self-taught, they hold examinations conducted by recognised men of standing in scientific and technical subjects. Great as this progress has been in recent years, there is a great deal to be done. In the first place, professors and teachers of engineering and technical subjects have to deplore the miserable previous training of a large number of students. It seems still to be a common idea that if a boy is unable to make any decent progress in the usual school subjects he can be sent to a technical school if he is useful with his hands, under the pathetic impression that the success of the engineer depends upon his hands rather than upon his head; and the first year or two at a technical school or college is thus taken up with work that ought to be done at a secondary school. It is not fair to put all the blame upon the school, for I have known students coming from the classical side of such a school with no knowledge of science and very little of mathematics who have taken the highest places in the engineering course, and, after entering their practical work, rapidly risen in the profession, and this was because such men had been well trained to apply their minds to any subject and had a sound foundation upon which to build. This only shows that a good student will always rise to the top, and does not prove that the present school system is the best for an average boy or makes him work as hard as, for instance, the corresponding school in Germany does. A large number of thinking men are convinced that our whole education system seriously needs reform. I say this not merely in reference to scientific education and technical training, but to the whole attitude of mind of the young of all classes of the community towards the serious work of life when they leave school. In the matter of education and its bearing upon technical training, we have, then, a good deal to learn from Germany. There are some things that we think are quite as good, if not better, in this country, but there is no reason why we should not try to find a way to adopt the better features of education from our enemy, and, while retaining independence of thought and originality, inculcate firmer discipline, for there is surely a happier medium in this matter.

I see in the report above alluded to there is a great divergence of opinion concerning the wage-earning value of highly technical students. Here, again, is a matter which in itself is worth a very careful discussion. The question depends first upon the student himself, next upon the kind of training he has had, and then upon the nature of the work he is expected to do. The blame in not getting the best results from a well-trained student is very often due to the employer, and our Section might do something to bring professors and employers into closer touch, and both employer and professor may have something to learn from each other.

In leaving this subject I cannot help pointing out what important continuation schools are to be found in the meetings and discussions of the younger members of various engineering societies and how much a young engineer learns in the preparation of a paper. Anyone who is accustomed to take the chair at such meetings will bear witness to the excellent outlay of money represented by the award of prizes and medals for such work. Many men to my knowledge have got jobs through thus showing acquaintance with a special subject or originality of thought.

Research.—If there is one thing more than another which the British Association can be congratulated upon, it is the work which it has done in the matter of research. To-day there is a more general recognition of the importance of research, and the recent institution by the Government of a Committee for the organisation and development of scientific and industrial research is the latest indication that the nation is beginning to realise its importance.

So far from all this making our work less necessary, there is all the more reason why we should have a permanent Committee of Research, because one of the intentions of the new Government Committee is to utilise the most effective institutions and investigators available, and the statement is made that one of the objects of the Government Research Committee is to select and co-ordinate rather than originate, and that one of its chief functions will be the prevention of overlapping between institutions and individuals engaged in research. It is more important than ever that the British Association work in research should go on, as, since its members are drawn from all parts of the British Empire, its influence should be correspondingly great.

Another reason for research being a subject of a permanent sub-committee is that suggestions for new work are more likely to be matured, and work of an advisory nature made more practical, than is possible at one annual meeting.

One more reason is that, although we have made some progress, we are still far behind Germany in the organisation of research. There is no doubt that our students and scientific men are quite capable of conducting researches, but the training for this is like the training for the officers of an army: it cannot be done hastily; and, indeed, men themselves cannot be obtained for this purpose without years of preparation. All such work must be done as a factor in the reorganisation of our manufacturing and commercial resources in the great struggle that lies before us.

There is one subject which affects both education and research, and might be reported on by our Committee. It is very rarely that a professor is both a good teacher and gifted with the power of original research. Even when a professor or lecturer is so gifted, however, it is almost impossible for a man to devote himself properly to research, and at the same time undertake the duties which are attached to a professorial chair. Why not face this subject boldly, even relieve the bad lecturer (there *are* men who admit their failure in this respect) of a certain amount of his work, provided he is doing well in research; or for the man who can do both well, see that he not only has efficient assistance, but, even more, that he is given the opportunity of devoting long periods (for instance, alternate years) entirely to research.

There are numerous other questions which would come up under this heading, and which could be usefully dealt with by our Committee.

One more subject that we might consider is a better differentiation of researches on purely industrial work, such as are often of a most profitable nature to the professor or research student, and those which are of a purely scientific character. While it is only right that every successful research, even if conducted at the expense of a public body, should bring solid return as well as fame to the worker, some steps should be taken as to the fair and equitable distribution of the proceeds. I see that one of the proposals of the new Research Committee is that discoveries by institutions, associations, bodies or individuals in the course of researches aided by public money shall be "made available under proper conditions for the public advantage." If the discovery is patentable, I assume, it would be protected at home and abroad, unless we wish to spend public funds as much for the benefit of foreign trade rivals as for ourselves. This is one of the many matters in connection with which a British Association Committee might from its cosmopolitan character render great service.

Standardisation and the Metric and Decimal System.—In the report of the Decimal Association last April, the hope is expressed that one of the changes for the better arising from the war will be a reform of our weights and measures. No class of the community would be affected more closely than the engineer, and engineers cannot fail to be interested in the question as to whether the general and immediate adoption of the metric system would or would not be a valuable means of assisting British firms in their competition with Germany and Austria, in countries where that system is in vogue. Although it is very unlikely that a wholesale change is imminent, it is certain that the metric system is gradually spreading, and in the United States and Australia very strong forces are on foot to bring about a change to that system. The British Association has over and over again had the subject before it, and our Committee might be of service in making a report on the present state of the matter.

One thing is certain: the Committee might be of assistance in recommendations which would bring into line all British engineers in duplicating tenders for countries which have the metric system.

Coming to standardisation, here we have more ground for satisfaction. The Engineering Standards Committee during the last ten years has done a work which is quite equal to that in any other country, of completing standardisation of all important matters in engineering, and, moreover, has secured the recognition of these standards in all public contracts. As giving some indication of the range of this work, it may be said that there are more than 60 committees for dealing with every conceivable engineering matter, from bridges, ships, and locomotives, down to electric lamps. One of the last of these committees, dealing with automobiles, has 11 sub-committees, many of which have already completed their work. It is almost impossible to do justice to the extraordinary achievement of bringing order out of what was apparently hopeless chaos and to the benefit to the British engineering industry of this work, largely due to the energetic Secretary, Mr. Leslie Robertson. We may justly pride ourselves that this Section was a pioneer of standardisation by taking up the subject of small screws, its work being taken over ultimately by the Standardisation Committee.

There is yet work to be done, however, and one matter of great importance would be to get a universal standard of temperature for instruments of measurement other than zero. A temperature, for instance, of about 62 deg. Fahr. would make steel rods' measures more practically workable than at present.

In connection with the subject of temperature and standardisation, I recently came across a statement by the General Secretary of the International Electrotechnical Commission (*Journal*, January, 1915) that the want of uniformity in the rating and testing of electrical machinery has been a serious evil, and he goes on to say: "The German standardisation

rules, for instance, which, through well-organised and combined effort on the part of the German makers, had previous to the war become widely recognised on the Continent of Europe as well as in many countries to which British machinery is exported, by permitting a higher temperature rise than is considered good technical practice in Great Britain, certainly have not assisted the British maker in foreign markets."

Exhibitions and Museums.—In recent years a large number of commercial exhibitions have been held of all branches of machinery, and it is satisfactory to note that one of the features of such exhibitions has been the holding of scientific lectures, and the inclusion of the exhibition of scientific instruments and apparatus, and also exhibits showing the relation of scientific experiments to engineering work. In some of the privately organised exhibitions with which I have been associated, the scientific men have been invited to take part when the general lines had been settled on which the exhibitions were to be run, and thus we had comparatively little influence. I have thought from time to time that it would be well if a permanent committee of such a body as the British Association existed, which could exert more direct influence, chiefly, of course, by reports and recommendations. The managers and organisers of such exhibitions would value assistance of this kind, and in return would listen to suggestions which might materially add to the scientific value of such an exhibition. I know from experience that a British exhibition is a most important means of promoting British industry, for the number of inquiries that come from all parts of the country and from all parts of the world show how much interest well-organised exhibits arouse and what long distances people will travel to attend such an exhibition. A machinery exhibition was to have been held in London, the date of the opening a week or two after the date at which the war began, but was, of course, not held. This exhibition was to have been Anglo-Dutch, and though organised by private enterprise was even in advance bringing in touch the consumers and manufacturers of the two countries. The *Beama Journal* quoted recently an American magazine in which the writer was advocating the support of a permanent commercial museum for industrial purposes, and this is what he said: "We produce a surplus of manufactures that must be sold. Our manufactured exports have about doubled in ten years—in truth a cause for satisfaction, and yet we have not accomplished enough. . . . We have only made a beginning, considering what we can do and will be forced to do in the future. . . . Manufacturers must compete with old-established nations in the market they seek to invade." It is noteworthy that this museum, which is really a permanent exhibition, is a very complete organisation, containing amongst other things science laboratories.

It is sad to think that the great hopes held out of the Imperial Institute by the President of this Association, Sir Frederick Abel, at the meeting held in Leeds in 1890, have not been altogether fulfilled. The President expressed the belief that, amongst other objects, the Institute would combine "the continuous elaboration of systematic measures tending to stimulate progress in trades and handicrafts, and to foster the spirit of emulation amongst the artisan and industrial classes." It may be a very fitting time to bring forward the whole question, because it has often happened that an excellent scheme which has somewhat languished has upon its revival at a later time, when its importance was better realised, been crowned with success.

Another matter which might be considered is the question of departmental museums at the technical schools and universities throughout the country. The organisation of these is simply a matter for the enterprise of the individual professor in each department. The museums in the engineering department of the colleges with which I have been associated were very much appreciated by the students, who constantly were the means of securing fresh specimens, and after they had left the college continued to contribute articles of great interest, such as fractures, corrosions, boiler plates, models, etc. This matter might be handled in a much more systematic manner, and possibly a report from our Committee with a recommendation to the proper quarters would be of use.

Patents and Patent Laws.—This subject is well worthy of the consideration of the proposed committee since progress in engineering, certainly on the mechanical and electrical sides, is largely dependent upon invention, which is not likely to be seriously undertaken without adequate protection, not entirely for the inventor, but also for those who really make the invention practical by means of capital and business support. A great deal of nonsense is talked and written about inventors, as if they were a special class of being, generally mad and always impossible. Some inventors are both, but the fact is, most engineers spend their lives seeking new ideas and devising new methods of carrying them out; in short, in inventing. It is of the greatest importance that every step should be taken to encourage sound invention and to see that anything of value is secured for this country. The foundation of the Munitions Invention Panel is a step in the right direction, and will, doubtless, be followed later on by Government Committees for peace inventions. Such committees or Government departments dealing with various industries will be assisted by suggestions from a body like this. Colonial patent laws are all different, and differ from those of the Mother Country. It would be a splendid thing if we could bring about a conference leading to unification of these diverse patent laws and have one comprehensive patent law for the whole Empire.

There are many other matters; for instance, the question of extending the time of secrecy in the provisional patent. For many important patents the close time allowed is not enough. Another is one in which the German system has certain advantages, viz., in having two classes of patents. One of these is the patent "proper," which is only granted after the most severe search and criticism, and holds the usual period when granted. The other is a secondary patent granted for the shorter term of five years, and is given for one of the hundred and one minor improvements and devices which, though of real value, only constitute small modifications in detail and not new applications of principle.

The suspicion of injustice to the British and other foreign applicants by the German Patent Office is to a great extent, if not altogether, unfounded. The German system of demanding that some definite principle is applied *to produce some definitely new effect*, might to some extent be followed, especially in view of the constant accumulation of published devices, some patented and others not.

Organisation.—This is by far the most important question of any I have raised, and practically embraces the others. To organise is to "arrange or constitute interdependent parts, each having a special function, act, office, or relation with respect to the whole." If we accept this definition, as we must, there is no question as to the all-important nature of organisation, for you will notice there are two outstanding things. The first "interdependent parts"; and the second their "relation to the whole." Thus the subject of organisation really includes the whole of industry.

When we come, however, to these interdependent parts and their relation to the whole, it is there that we find the weak joint in the armour. It is in this respect that Germany can teach us a striking lesson in the *arrangement* of these interdependent parts with respect to the whole. From the top to the bottom the whole forces of their industries are so thoroughly organised that they get all that is humanly possible out of the various factors. I do not limit this merely to the wonderful organisation of any works, like Krupps, or the Deutsche Maschinenfabrik, or hundreds of other works, but I include the organisation of all the Government departments, together with the banks, the railways, and the shipping, so that every facility is afforded for the world commerce of the German Empire.

Taking only one of these details, I remember, when the battle of the Manchester Ship Canal was being fought, what facts came out as to the difficulties in the transhipment and handling of goods. The late Mr. Alfred Holt, for instance, was one of the most earnest in pointing out that the want of co-operation and organisation in getting goods from our manufacturing centres was adding largely to their cost, and actually exceeded the cost of transporting these goods across the ocean. In Germany, on the other hand, the Government steps in, and by means of special differential rates, gives the manufacturer every facility and the lowest possible rates for obtaining raw material, and delivering the finished goods to all parts of the world. It was this organisation that not only rendered Germany so formidable a rival in times of peace, but makes her so powerful in war.

This co-ordination in Germany is carried out in every industry in a way we generally have little idea of. For instance, the other day, at a deputation to the Government, Mr. Runciman remarked that the difficulty of connecting the manufacturers with the commercial staffs in this country is deep seated, but, perhaps, not altogether incurable. Further, that the manufacturer must realise what he can get from the universities, and the university must know what the works require. Dr. Foster, the treasurer of the Chemical Society, also said that "the Germans are so imbued with the need of pursuing modern and efficient methods of education, in applying science to industry, that they hold in contempt a country which notoriously neglects such processes"; and he attributed this contempt as partly contributory to their cheerfulness in entering into the war with us.

Now while these remarks are undoubtedly true, they are only a part of the truth. The evil is far wider than in any special application, for, as the German knows perfectly well, there are innumerable individual cases of organisation in this country of equal efficiency to any in his country, and he is glad enough to learn from special cases.

I do not believe the Germans despise us for our want *per se* of the application of science to industry. I do not think they have much reason to; but what they do despise us for is the want of co-ordination, which, I venture to say, amounts to positive slackness, which they are keen enough to observe permeating the whole of this country. They see different sections, instead of being united for a common end, quarrelling with each other, filled with mutual suspicion and distrust, with, apparently, no common bond of union, and whereas the German is proud of the Fatherland, he sees in this country large numbers who seem, either through self-consciousness or ignorance, to be ashamed to mention the subject of the British Empire, or, what is worse, to acknowledge that any love of their country is or could be a mainspring and incentive to strenuous effort.

The other day, Field Marshal von Moltke stated, and there is no reason to disbelieve him, that great as was the shortage of ammunition and shells before the war, the enormous demand far exceeded all expectation, and Germany found

herself for a time in the same plight as her enemies, but he further stated that Germany's emergence "from this dangerous position was largely due to the extraordinary organisation, which included not merely the adaptation of their factories for munition purposes, but *capacity for work of the people*, and the *patriotic spirit of the German workmen*."

This brings me to consider what is probably the most serious feature in our national life to-day, which I have already alluded to under the heading of education, viz., the relation of employer and workman. It is hopeless, as long as such ideas prevail as seem to do at present, to think of any sound organisation of our industrial system taking place, because the interdependent parts are not arranged (and can never be arranged until we change radically) with respect to the whole. Now as one who has served an apprenticeship, who has taken his money weekly from a tin box with hundreds of other men, who has been a member of the Amalgamated Society of Engineers (in fact, was working as an engine fitter when a Whitworth scholarship made a college career possible), I am the last man to put this evil down entirely to the working man. I know, individually, he is just as capable of patriotism as any other class. Get him by himself, even the men whose strikes have caused such despondency in the minds of our Allies, and who have seriously jeopardised the very existence of the country, and you will find (except in the sort of case to be found in all classes of society), that he, as an individual, is willing to make sacrifices, and if necessary to give himself for his country. The truth is that the canker which is eating the heart out of our industrial life is due to an entirely wrong attitude of mind. For instance, however much we may sympathise with men who see a loss of employment in the introduction of labour-saving machines, some means should be found by which they can share the benefits to the State and to their employers by the introduction of such machines. I should like, if I had time, to say something about the marvellous organisation of the Ford motor-car works in America, and how it has given the men a share in the returns of a great industry, and thereby induced them to work in a way that has enriched themselves, their employers, and their country. We have many splendid examples of this co-operation in this country. For instance, Messrs. Allen, of Bedford. Again, the employment of women in the engineering industries has taken place in many directions owing to the war. The works with which I am associated could not have undertaken much munition work without it. Some steps should be devised by which this avenue of industry is not closed to women after the war, while justice is secured for the men alongside of whom they are working, and from whom they are in many instances learning mechanical skill. Again, the questions of piecework and overtime must be seriously considered by the State, and not allowed to become the subject of disastrous disputes. Once more, there is the question of a standard wage. It is against the eternal laws of Nature to try and keep living beings at one dead level of equality and merit—*i.e.*, it is against the law of the survival of the fittest. The trade unions have a great opportunity of placing their country and themselves in a leading position amongst nations if they will courageously grapple with a great problem by recognising degrees of merit and corresponding degrees of payment. These are a few of the many matters which must be dealt with in the immediate future.

The matter of labour disputes is so serious as to demand plain speaking. It must be admitted that there are many employers and companies which, to satisfy themselves and their shareholders, extort the largest possible dividends and pay the smallest possible rate of wages, and do so apparently without the slightest idea that the men and boys under them are capable of education and personal influence. Can it be wondered, then, that men under these conditions are willing enough to listen to the orator who merely appeals to their fighting instincts and join in the game of grab as against the employer? On the other hand, strikes have occurred when employers have honourably carried out their obligations and undertakings, and the men have shamefully departed from an agreement made by their chosen leaders, throwing over the leaders the moment they have fancied it to their own selfish interests to do so and without a single thought of their duty to the community as a whole.

We have recently seen the Prime Minister and other leading statesmen struggling, sometimes in vain, to bring large bodies of men to a reasonable state of mind. Is not this (and I speak without the slightest reference to party questions) a case of nemesis overtaking us for having in so many cases pandered to the selfish instincts of large bodies of men in order to secure their votes, instead of sternly telling them unpalatable truths?

There was recently an intensely interesting article by the late Professor Friedrich Paulson, previously Professor of Philosophy in Berlin University, published in the *Educational Review* of New York. In this article, the subject of which was "old and new fashioned notions about education," he pointed out that the whole of our educational system was going wrong, and that we could not escape the conviction that a tendency towards weakness and effeminacy was its chief trait. His three mottoes were: Learn to obey; learn to apply yourself; learn to repress and overcome desires; and he remarked with great truth under the first heading: "He who has not learned to do this in childhood will have great difficulty in learning it in later life; he will rarely get beyond the deplorable and unhappy state that vacillates between outward submission and uproarious rebellion." Is not one of the first things the reform of our educational system?

The other day a writer in the *Spectator* said with great truth that "what Great Britain is suffering from acutely and dangerously at the present time is the absence of discipline," and a neutral writer in the *Times* remarked as follows: "The uniformity of German effort, due doubtless to their myriad well-organised, machine-like minds, though it renders them excessively tiresome people to dwell among in peace time, enables their Government to extract every ounce of energy in the conduct of a war." He further went on to say that the British Empire "could not have been created by minds like these, but it should not be forgotten that in the concentration necessary to national effort in a struggle like this the German system of self-subservience to the State has enormous advantages."

One of the tasks to which the British Association might bend its energies, with the greatest benefit to the country, is to bring about a reform of our educational system, so that while we do not kill individual enterprise and freedom of thought, which have contributed so largely to the political organisation and constitution of the British Empire, of the value of which we have had such wonderful evidence from our colonies and dependencies during this war, we seek to implant in the minds of young and old those ideas of discipline and service to the State, the want of which so seriously threatens the successful organisation of our industrial life.

Conclusion.—In bringing my address to a close, I hope I have made it clear that I have had throughout a practical object. Expressed briefly, it is that the service of every agency is wanted for definite work at this crisis, both in the actual war, and afterwards in the war of industry which will be waged with equal intensity in peace time. The British Association cannot be said to have undertaken as a whole a work of this kind, yet one finds a general desire on the part of every member that something should be done. With this object, I communicated with the President, and found that both he and such of the officers as could be got into touch with were in entire sympathy with the general proposal, and advised that our section, like that of Economics, should start at once with a committee on the subject. I have great hopes that such a committee will be formed, but I have no hopes of either our own sub-committee or the committee of the Association as a whole doing any good, unless they are prepared with definite suggestions and advice which cannot be ignored and put aside. I have not the slightest faith in the mere formation of a committee which will content itself, let us say, with the mere offer of its services, even to a Government department, and the mere pious expression of certain opinions. If a committee does not want to become ridiculous, it must show that it is in earnest. To show that it is in earnest it must take care that its reports have a practical object, can be at once grasped by overworked Ministers and officials, and are of real value. Fortunately, the British Association is a powerful body with great traditions, and will be listened to if such work is carefully and energetically done.

We can at least congratulate ourselves that whatever the evils of the war, the country as a whole has been moved from its usual attitude of self-complacency, and that the numerous new departments and organisations are showing a desire to utilise every force and agency for the service of the State, and to grapple with the great problem of its more efficient organisation. It will be no small work of a British Association committee if it can supply sound ideas and recommendations on the many thorny problems which must be solved. We cannot all of us be, as so many would like, in the fighting line, either in France or the Dardanelles, but we shall be just as deserving of contempt as those who, having had the opportunity of service, have shirked their responsibilities, or the giving up of their sons, and are even thinking of the war as a matter of personal gain, either in purse or reputation, if we content ourselves with mere offers of service, and having, as we think, shelved responsibility by leaving initiative to others, we pass along our way sheltering ignobly behind those men and women who are doing their duty to their country.

Prof. Unwin, who moved a vote of thanks to Dr. Hele-Shaw, remarked that a great deal of the presidential address had touched on the question of engineering education. Progress had been made. One remembered days when it was an absolute disadvantage for a young man going into engineering to have had an education of any kind. They were getting past that now, but were not yet entirely past it. They were coming to see that besides the very practical knowledge a man must obtain in the works or factory or office he ought to have a good technical training. He thought the difference between technical training in this country and Germany had its root very much in this: in this country much attention had been given to the education of what they called—without any idea of contempt—the lower classes. On the whole, our education of the artisan and working population was probably even better than that of Germany. But the Germans began in a different way; they began at the top, and got some of their very best men to start the education of those who were to become engineers. They made mistakes at the beginning—they made their education far too theoretical—but they had worked clear of that. In Germany the organisation of technical education had rather proceeded from the top downwards than as in this country from the bottom upwards.

Thermal Efficiency of a Gas Engine.

By PROFESSORS G. ASAKAWA AND J. E. PETAVEL.

(*Section G.—Abstract.*)

At the Birmingham meeting of the British Association a preliminary note bearing on the above subject was read. The investigation has been continued during the last two years and has led to the conclusions summarised below. The various losses have been separately determined by measurements based not on indicator card readings, but on the rate of change of the kinetic energy of the rotating parts, and thus the errors inherent to the indicator mechanism have been avoided.

In the following summary the performance of the engine is compared with that of a perfect engine working on the same cycle and with a similar gas mixture.

Indicated Horse Power.—At full load under the most favourable conditions the indicated horse-power of a gas-engine is 88 per cent. of that of an ideal engine working with a similar mixture. This holds true for all except very weak mixtures, for which the relative efficiency is lower.

For mixtures containing only a slight excess of air, the above corresponds to an absolute thermal efficiency of 27 per cent. at a compression ratio of 3.75 and 33 per cent. at a compression ratio of 5.6; for mixtures containing twice the amount of air required for complete combustion the absolute efficiencies are 29 per cent. and 36 per cent. The indicated efficiency relative to the gas-standard falls from 88 per cent. to 84 per cent. between full and no load.

Brake Horse Power.—At the full load the brake efficiency relative to the gas-standard varies from 70 per cent. at the compression ratio 3.75, to 67.5 per cent. at the compression ratio 5.6; this holds true for all except the weakest mixtures, for which the relative efficiency is lower. The absolute brake efficiency is 21 per cent. at compression ratio 3.75 and 25.5 per cent. at compression ratio 5.6 for mixtures containing little excess of air, and 23 per cent. and 27 per cent. respectively for mixtures containing twice the amount of air required for complete combustion. The maximum brake efficiency obtained in the present experiments was 27.4 per cent., and occurred at the highest compression ratio for a mixture slightly stronger than this.

At light loads, the brake efficiency relative to the gas-standard decreases more rapidly as the compression ratio rises. For the higher compression ratios the increase of theoretical efficiency is just counterbalanced by the increase in frictional loss, and thus the absolute efficiency remains constant.

Mechanical Losses.—The mechanical losses increase slightly in absolute amount with the load and with the compression ratio. For the engine under test (a 25-H.P. National gas engine) at normal speed (200 R.P.M.) the mechanical losses amount to 5.6 H.P. at no load and 6.3 H.P. at full load when the compression ratio is 3.75; and 6 5 H.P. at no load and 7.0 H.P. at full load when the compression ratio is 5.6.

The pumping losses are an important part of the total mechanical losses; at a compression ratio of 4.85 they represented 2.3 H.P. at no load and 2.1 H.P. at full load, or 38 and 31 per cent. of the mechanical losses.

Thermal Losses.—The loss of power due to thermal losses at full load under most favourable conditions amounts to 12 per cent. of the total available energy, and at no load to 16 per cent.; of this less than one quarter is due to heat transmission during the expansion.

A Gas-Producer for Steam Boilers.

By E. C. MILLS.

(*Section G.—Abstract.*)

The aims of the inventor of the Mills furnace were:—

1. It should not be too costly.
2. It must utilise the radiant heat of combustion.
3. There must be ample temperature to ensure complete chemical combination.
4. Access to boiler for examination and repairs must not be hindered.
5. The whole of the various gases given off by the fuel must be immediately burnt with their sensible heat of production in them.
6. Little or no excess air must be used.
7. All ordinary qualities of coal must be useable.
8. Attendance must not be excessive.

The results of tests on a Cornish boiler, worked on an ordinary internal fire and with the Mills producer, with the same fuel in each case, and tested by the same expert, show a saving of about 50 per cent., and there was no smoke.

Tests on a Lancashire boiler with the Mills producer give high efficiencies and standardised evaporations ranging from 10.23 lb. to 11.47 lb. of steam from 1 lb. coal, and on a comparison with another boiler fired with the same fuel, but with the ordinary internal fire, the tests show a saving of about 18 per cent. in evaporation. In this case also there was an entire absence of smoke.

Patent Application.—Application has been made by Philip Francis Oddie, for the restoration of Patent No. 24,539, of 1907, for "Improvements in duplex pumping engines."

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The A.E.G. Meeting.

I have read with interest, and not without amusement, your report of Dr. Walther Rathenau's extraordinarily anti-English speech at the extraordinary meeting of the above company. This induces a train of thought which ends in the Electrical Co., Ltd., Charing Cross Road. I observe that the premises are still open, and understand that the business is still "in being." As the authorities are no doubt seeing that no enemy goods are being imported from, and that no money is being transmitted to, Germany, it can only be assumed that the Electrical Co. is selling British-made goods. All efforts to draw this company have, so far as I know, failed, but I think that the time has come when the B.E.A.M.A., the I.E.E., or the E.C.A. should take the matter up and force this company to state what kind of business it is carrying on, and where it is finding the money from to carry on. Obviously the place is being kept warm for German business and capital and staff after the war, and it would be interesting to know who the Englishmen are who are assisting in this respect. I refer not only to the staff of the Electrical Co., but to those contractors or manufacturers who are apparently helping to keep this concern "in being."

I do not think I am making a mistake if I state that the trade looks to you in a matter of this kind to agitate until something is done.

Inquisition.

September 10th, 1915.

Electric Power in India.

With reference to the three letters published in your issue of July 23rd last over the signatures of "Accuracy," "British Representative," and "A Ditcher," it is regretted that they have not had the courage to sign their name to their communications.

From the manifestly incorrect statements appearing in each letter, I can only conclude that they all have been inspired from the same source and that the experience of the initiator has been confined chiefly to wiring, electric lights, and fans, with which my paper is in no way concerned, and that the author's practical knowledge of power plant, which subject alone is dealt with in the paper, is of the most limited description.

A reference to the records of sea-borne trade of British India and foreign countries, compiled in the office of the Director General of Commercial Intelligence, would have shown at once that the percentages given by me appertaining to electric, hydro-electric, and steam turbine imports from Great Britain compared with those of Switzerland, Germany, and America are, in fact, correct, and if those who presumed to criticise my paper had taken the trouble to seriously study the paper, before attempting criticism, they would have found there a table, compiled with the assistance of the engineers in charge of the more important electric supply companies at work in India at the present time, which shows that of a total station capacity of approximately 90,000 H.P., Switzerland supplied engines to the extent of 72,000 H.P., England 11,000 H.P., and the U.S.A. 7,000 H.P. The electrical plant was supplied as follows:—

Germany no less than	43,000 H.P.
United States	23,000 H.P.
Switzerland	14,000 H.P., and
England	10,000 H.P. only.

The above facts dispose of such arguments as are contained in my critics' letters. The remainder, consisting, as it does, of mere abuse of myself, in itself sufficiently indicates personal bias to show the value of the criticisms.

The reference, however, by "British Representative" to the Calcutta Local Section of the Institution is misleading in view of the fact that its opinion can in no way be taken as representative. It does not number amongst its members many engineers who, by practical experience, are entitled to express an opinion, and who actually represent in India a number of the largest British electric power plant manufacturers.

A reference, therefore, to the local Institution as at present constituted, for its opinion on papers dealing with electric power, hydro-electric, and traction work, as distinct from wiring, lights and fans, would certainly not be welcomed by the authors.

The letter above the signature of "A Ditcher" contains allegations so damaging to my reputation, both as a professional man and as an Englishman, that I have felt constrained to place the matter in the hands of my solicitors, and, therefore, do not propose to deal with these accusations now further than to state that:—

1. I am a natural born British subject and that, to the best of my belief, I have always acted as such.
2. I am not open to look after the interests of any electrical manufacturers, but, as my profession is that of consult-

ing engineer, it is obvious that I am glad to be appointed consulting engineer to mills and factory owners.

3. It is perfectly true that whilst in the pay of the A.E.G. and the Lahmeyer Electrical Co. I did my best to further their interests, but, in order to establish a consulting practice, I resigned these two very valuable agencies when on a visit to Berlin in 1912.

4. It is equally true that I am interested in the Hupmobile, which is an American car, but with, I may add, the sanction of the Council of the Institution of Electrical Engineers.

My correspondents appear to suggest that it is an unpatriotic act to hold an agency for an American concern, and I can only say that, if this is the case, the number of patriots amongst the business community of Calcutta, or in any other large commercial centres, must be remarkably limited.

Speyer & Co.

Calcutta, *August 18th*, 1915.

[With reference to point No. 4, as we imagine it not improbable that the whole subject will come before the Council of the Institution of Electrical Engineers we refrain from comment at this stage.—Eds. E.R.]

Lighting Developments.

I have read Mr. Crouch's article on "Lamp and Lighting Developments" with great interest, and should be glad if you or your contributor could advise me where I can find the latest and fullest particulars of the development of the Moore and Neon lights to date. Thanking you in anticipation,

Wm. A. A. Burgess, A.M.I.E.E.

Sutton, *September 8th*, 1915.

Increased Charges and Special Contracts.

Now that increased charges are being made by nearly all supply undertakings in consequence of the abnormal rise in the price of fuel, caused by the war, it would be interesting to know whether proportionate increases can be made on existing special contracts; for instance, a contract made three years ago giving the consumer a specified charge for a period of five years. Can this charge be increased on the grounds that the contract was made when no one could have predicted a long and serious war such as the present one? Readers' opinions on these points would be very useful to your

Inquirer.

Church Lighting.

I should be glad if you could give me your opinion or your suggestions as to installing electric light in churches, where it is considered inadvisable to use the ordinary electroliers, these latter not being in keeping with the architecture of the building. Could the indirect lighting system be utilised with advantage? Any suggestions you could let me have through the medium of your columns would be acceptable.

Lux.

[The lighting of churches, which is so frequently effected by most unsuitable means, is quite a special branch of illuminating engineering; no two churches are alike, and every case must be dealt with on its own merits. It is, therefore, impossible to say that this or that system is to be preferred. In general, we should advise the rejection of proposals for the conversion of existing fittings and lay-outs, and the adoption of a scheme appropriate to the surroundings, under the guidance of an expert in this particular branch. The wholly indirect system could seldom be employed, owing to the height of the roof; reflecting indirect-lighting fittings, while meeting this difficulty, would be too obtrusive in daylight. The ordinary methods too often result in great discomfort to the congregation, and we strongly recommend our correspondent to obtain competent advice on the subject before embarking on a scheme.—Eds. Elec. Rev.]

Wrinkles on the Operation of Alternators.

"Switchman" puts a case where the only guides for regulating the fields of alternators in parallel are the field ammeters of the machines, but he surely does not mean me to understand that no main ammeters are in use? I have pointed out that if the fields of alternators running in parallel are correctly regulated, the sum of the main ammeter readings will be a minimum. If of two machines running in parallel, one has too strong a field and the other too weak, the resultant voltage may be normal, but idle currents will circulate between the machines and the sum of the main ammeter readings of the two machines will be greater than the possible minimum.

With regard to the last question, I should not have thought that the fact of another alternator being switched in would require any alteration whatever in the field strength of the rotary, provided all is in proper order.

E. B. Pausey.

Bury, Lancs., *September 6th*, 1915.

WAR ITEMS.

The A.E.G. as an Oracle.—It is now nine months since the chairman of the A.E.G., presiding at the annual meeting held in Berlin last December, made an extraordinary speech in relation to the situation created by the war and the future prospects of the Fatherland. No less remarkable and optimistic was the second speech which Dr. Walter Rathenau delivered on September 3rd at a special meeting of the company, when sanction was sought and eventually obtained to a scheme for increasing the share capital by the issue of new shares for £1,800,000 for the purpose of effecting an interchange of shares with the Berlin Electricity Works Co., of which details were given in this journal a fortnight ago. The only omission then made—or, rather, the announcement had not been published at the time—is that this proposed extension of a community of interests, which will bring the A.E.G. in association with the comprehensive lignite mines in the vicinity of Bitterfeld, is considered to be appropriate, because the company will find it necessary in the near future to make considerable changes in working which will render it essential for many works to remove to a centre of coal production.

If we now turn to the speech itself, we find that the shareholders were first reminded of the previous address where the necessity for the transformation of German industries from peace work to war work had been pointed out. The change, we are told, was effected in a surprisingly quick manner, and the company for its part co-operated in the movement. In the late autumn of 1914 Germany was confronted with entirely new questions, both in regard to the provision of war material and peace requirements, which arose from the situation which was forced upon the country through the English blockade. How this state of affairs was met Dr. Rathenau naturally refrained from informing the meeting. We are, however, becoming somewhat sceptical concerning the constant reiteration by one company after another, and by one learned society after another, that all the needs of the country in raw materials have been satisfied by drawing upon national resources. It is certainly known that some metals have been substituted for others, and that nitrates are being produced on a larger scale than formerly, but when it was actually stated at an assembly of technical men several months ago that no copper was needed, as a substitute had been provided, our credulity was strained to its utmost limit. The chairman of the A.E.G., however, did not proceed to this extreme. He stated that the anxiety in respect to raw materials had completely given way, and it could be joyfully said that this was rendered possible through the organisation of work and methods which were employed with the traditions of the company. It is, however, impossible to understand how organisation of work and methods could compensate for any deficiency in the supply of raw materials, but that is the statement. The blockade, we are further told, no longer oppresses the Germans; on the contrary, the position has been reversed, as the country which imposed the blockade in the hope of exhausting the Germans industrially, and of killing them economically, was suffering most severely for its own freedom from the blockade. We alluded to this part of Dr. Rathenau's speech last week.

The actual position of the A.E.G. next engaged the attention of the chairman, who remarked that the inland industries or domestic economy led to results which influenced the monetary situation of the company. The liquidity of the company, whose cash resources are reported to have risen from £4,150,000 to nearly £5,000,000 at the end of June, did not cause any anxiety to the directors. The shareholders were informed that they were living in a period of great sale. The stocks held at the works were diminishing as also were the outstanding debts, and the correlative of that phenomenon was the liquidity of the total means of the country and also of the company. In this process of realisation—in this partial sale of goods—the chairman said there would be seen a matter which was economically gratifying. The explanation of this assertion was that during the present times Germany was getting rid of all surplus stocks which were not urgently required, and it might be said that in relieving herself of stocks a part was also played by the removal of drugs in the market. Lest his audience should conclude that the A.E.G. produced drugs on the market, the chairman hastened to add that he would not say that the company had such stocks, but that the clearance had taken place to a far-reaching extent, and the company thereby felt strengthened and equipped for new problems. Are we to conclude that the great sale, general as it appears to be from the preceding statement, represents a great diversion of the goods for the purpose of finding materials for the continuance of the war? It certainly seems that this is the case, and that the boasted independence of external sources of raw materials is far from reaching the stage of being founded upon fact.

The question of the future is of particular interest. On this point the speaker stated that it could not be concealed that the double preparation with which the company was confronted—the preparation for the prolongation of the war and the preparation for a speedy conclusion of peace—was perhaps the more serious part of the work as compared with what had been performed hitherto. The directors believed that by strengthening the manufacturing and industrial intensity they could find a remedy for a portion of the falling-away exports, for a portion of a slowed-down European economic situation, and for the effects of impoverished foreign countries. The strengthening of industrial intensity would be a general problem for Germany; the company did not wish to be behindhand in this respect and hoped to solve it satisfactorily. At present the stock of orders and the number of the company's account were almost equal to those at the corres-

ponding period of 1914, although the early months of the war had a paralysing influence on business which was comprised in the financial year, for which the books were now being closed. Dr. Rathenau, under these circumstances, deemed it to be premature to make any announcement as to the financial results, but he held out the prospect of a higher dividend which, however, would be partly determined by the political situation, which "is taking so hopeful a course through the brilliant victories of our armies."

If any further comment on the chairman's address be necessary it is afforded by the fact that the tone of buoyancy and confidence which characterised the speech delivered at the end of last December has entirely disappeared. But this new feature in the situation is becoming by no means uncommon in that country. At the same time, the admission is noteworthy that the Germans expect to lose a portion of the export trade in electrical engineering manufactures. Certainly engineers in the Allied countries will strain every effort to secure the exclusion of Teutonic commodities after the conclusion of peace, and they will have the right to claim that domestic customers shall give them every support in this direction. So far the Germans have entertained the idea that they would be able to resume business in the future at the stage at which it was suspended by the war, but the statement of the chairman of the A.E.G. shows that the recognition is now dawning even in German minds that business as usual can no longer be a motto as between that country and the Allied nations.

Application to the Bolton Munitions Court.—The Munitions Court for the Bolton district had before it, on the 8th inst., an application by James Vickers, an employé in the electrical department of Messrs. Henry Bessemer & Co., who desired a certificate giving him permission to work elsewhere. He had been an apprentice at the works, and had just come out of his time. He stated that he had asked for his full journeymen's wage, and, being refused, gave a week's notice. When he asked the firm for his discharge papers, so that he could go to some other munitions firm and earn more money, they referred him to the Munitions Court. It was stated for Messrs. Bessemer that it was usual for apprentices to work up to the full scale by instalments, and the same terms were offered applicant as were accepted by other employés. Questioned by Dr. Sellars, barrister, who presided, the applicant said it was not usual for an apprentice, when he came out of his time, to go on full wage, but the apprentice, added Vickers, could leave. Dr. Sellars, however, said that under the Munitions of War Act he could not leave. He could in peace time, but this Act made all the difference. The Court found in Messrs. Bessemer's favour.

Westinghouse War Relief Fund.—We have received a copy of the fifth statement of receipts and expenses in connection with the British Westinghouse Employés' War Relief Fund. Of the total contributed to August 31st last, amounting to £14,625, £10,134 has been contributed by the employés and £4,491 by the company, and out of this sum £8,598 has been paid to dependents, £2,500 set aside for a Widows' and Orphans' Fund, and over £1,200 has been spent in donations to outside funds, Christmas gifts 1914, and payments to Red Cross workers. The number of families receiving relief is 621, and the number of the company's employés who have joined the King's Forces is 1,572. The very considerable amount of work involved in administering the funds has been performed by members of the company's workmen and staff voluntarily, and without expense to the fund. Everybody concerned is to be congratulated on so fine a statement.

War Lighting Restrictions.—As there has been some interference with the street lights on the part of pedestrians, who think that at air-raid times in the metropolis it is necessary to still further reduce the public illumination, it may be as well to refer readers to the statement on the matter issued to the Metropolitan Borough Councils. This was published in the Electrical Review for June 25th, 1915, p. 888. The Commissioner of the Metropolitan Police now draws attention in the Press to the fact that any person unlawfully extinguishing a street lamp commits an offence, and is liable to summary arrest. The present reduction of street lighting has been effected in accordance with a considered scheme, and the unauthorised extinction of lamps may create confusion and danger.

Trading with the Enemy.—As doubts have arisen regarding the position under the proclamations in force relating to Trading with the Enemy of incorporated companies or bodies of persons which, though not incorporated in any enemy country or in territory in hostile occupation, carry on business in any such country or territory, a new proclamation is now issued declaring as follows:—For the purposes of the proclamations for the time being in force relating to Trading with the Enemy, the expression "enemy," notwithstanding anything in the said proclamations, is hereby declared to include, and to have included, any incorporated company or body of persons (wherever incorporated) carrying on business in an enemy country or in any territory for the time being in hostile occupation.

Controlled Munitions Factories.—On September 4th, Mr. Lloyd George announced that 180 additional establishments were now controlled establishments under the Act, making the total 715.

"The Message of the Flag."—Mr. Charles R. Wylie, who is an old Silvertown cable engineer (he was with the company for more than 20 years), some time ago wrote a song—"The Message of the Flag"—set to music by Capt. R. W. Mockridge, and sold by West & Co. It is dedicated to "every man who is doing his little bit for the honour of the Empire and for England." Capt. Mockridge is now at the Front in France, and Kennerley Romford and others are singing the song to the men on active service there and elsewhere. The first verse and chorus read:—

It's only a wisp of bunting, made of red and white and blue,
Growing rather worn and tattered, for it's long since first it flew
Through rain and fog and tempest, through battle smoke and flame,
And it's flapping out a message in the dawning:

Refrain. *Repeat for Chorus optional.*

"Here's to the swinging turret! here's to the rolling drum!
And the bugles shrilly sounding that 'The Day' has come,
And here's to ev'ry fighting man who answers to the Call
For the honour of the Empire and for England."

America and the Russian Market.—According to a Reuter dispatch from Chicago (*Financial Times*) plans for the establishment of closer trade relations with Russia by means of an American co-operative sales company are under consideration by leading American manufacturers. They propose to take advantage of Russia's invitation to sell goods in Russia now while sentiment is friendly to the United States. The manufacturers' association is to be known as the International Manufacturers' Sales Co., of America, and will have offices in Chicago and Moscow.

Elementary Mechanics for Wounded German Soldiers.—The Physical Section of the Elektrotechnische Lehranstalt, of Frankfort-am-Main, is devoting special attention to the instruction of soldiers who have lost limbs in the war. Some time ago it inaugurated a course in elementary mechanics at the convalescent home in connection with the Orthopædic Hospital, while now it is announced that it is starting a similar course for one-arm soldiers.

Board of Trade List.—The Commercial Intelligence Branch of the Board of Trade during the week ended September 4th received inquiries for sources of supply of the following goods (List No. 37):—

Aluminium bars, notched.
Engines, petrol, small and cheap for driving pumps and churns.
Furnaces, small electrical, for experimental purposes.
Switches, E.L. tumbler.

BUSINESS NOTES.

South African Trade Figures.—The Customs Department has issued a statement of the trade of the Union and of British South Africa for the month and six months ending June 30th. The figures are, in some respects, remarkable. During June the total imports, including specie, were actually nearly as large as in June of last year, the figures for the two months in question being £3,119,350 and £3,150,305. The imports of merchandise amounted in value to £2,523,296, as against £2,752,286 in June, 1914. Leaving specie movements and Government purchases of stores out of account, the actual value of the imports of the past six months amounts to £12,509,221, as against £17,346,047 in the first six months of 1914. The decrease in the war period has been at the rate of nearly 28 per cent., and it has been spread over a variety of articles of commerce. An important table attached to the Blue Book shows the value of imports of merchandise into British South Africa, distinguishing countries of origin, during the six months of 1915 and the first six months of 1914. In the first half of last year the imports from Germany represented 9¼ per cent. of the total imports, the value being £1,715,472. During the past six months, of course, German trade with this country has practically ceased to exist, though it may be remarked that by some means or other German goods to the value of £71,925 are recorded as having entered the Union. Presumably these were already *en route* before the outbreak of the war. In the case of the United Kingdom our imports increased from 55·4 per cent. of the total to 57·7 per cent., and, if we take in the figures for the rest of the Empire, it will be found that the increase was from 66·8 per cent. in 1914 to 69·2 per cent. in the present year. The United States has, however, benefited most materially by the destruction of German trade. In the first half of 1914 our imports from America were £1,685,000, or 9·3 per cent. of the total, and this year they were valued at £1,833,000, or 14·2 per cent.—*South African Mining Journal.*

Our Trade in China.—The Board of Trade announces (says the *Times*) that arrangements have been made by the Foreign Office in accordance with which his Majesty's Commercial Attaché at Peking, and the Assistant Commercial Attaché, who is stationed at Shanghai, will be prepared to assist British firms in need of agents in China by putting them in touch where possible with suitable British agents in that country. Firms desiring to take advantage of this offer should communicate with his Majesty's Commercial Attaché for China, care of the British Legation, Peking, or with the Assistant Commercial Attaché, care of his Britannic Majesty's Consul-General, Shanghai.

Bankruptcy Proceedings.—Herbert Page, electrical engineer, 63, Queen Victoria Street, E.C.—Under this failure a sitting of the London Bankruptcy Court was held on Tuesday before Mr. Registrar Hope for the public examination of the debtor who returns total liabilities £2,278, of which £2,157 i

expected to rank against net assets valued at £91, after deducting £85 for payment of preferential claims. In reply to Mr. Egerton S. Grey, Official Receiver, the debtor stated that prior to 1891 he was in the employment of a firm of electrical engineers. In that year he started in partnership with Mr. Charles Henry Smeeton, at 63, Queen Victoria Street, E.C., and they traded as "Smeeton and Page." Neither of them had any capital, but Mr. Smeeton borrowed £150 from a relative, who had since been repaid. The partnership was dissolved in 1894 because they did not make sufficient profit to keep two persons. Under the deed witness took over the liabilities and assets, and paid £200 to Mr. Smeeton, partly in cash which was borrowed from the bankers, and partly in bills. He (debtor) continued the business until January, 1908, and then executed a deed of assignment; the assets realised £363, and a dividend of 3s. 6½d. in the £ was paid on liabilities amounting to £1,776. That failure was due to losses on contracts and bad debts. The creditors allowed him to retain the little stock that was on hand, and he continued the business at the same address, with success, until 1912, when he was again short of capital, and began borrowing from friends and others, to whom he now owed £1,550. A balance-sheet prepared in 1912 showed a surplus of £36, but no consideration was taken of loans, and a deficit of £150 should have been disclosed instead of the surplus. During the ensuing two years the trading resulted in a loss of £390, whilst his drawings for that period amounted to £851. All his borrowing powers were exhausted by the beginning of the present year, and in May, being pressed by creditors, he consulted his solicitor, upon whose advice he filed his petition. Witness attributed his failure and insolvency to bad trade, lack of capital, to loss caused by the builders' lock-out in 1914, and to the war. A full set of books of account were kept in the business. The examination was concluded.

John Taylor Peddie, mechanical engineer, Exhibition Buildings, Aldwych Site, Strand, London.—Receiving order dated September 8th, on a creditor's petition. First meeting September 22nd; public examination October 22nd, both at Carey Street, W.C.

T. H. Rigg, electrical and mechanical engineer salesman, Green Lane, Pannel Ash.—Receiving order made September 9th, on debtor's own petition. First meeting September 24th; public examination, October 8th, at York.

V. G. Cobb, electrical engineer, Nottingham.—Order made August 19th suspending discharge for 2½ years. Assets not equal to 10s. in the £; proper books of account not kept; bankrupt continued to trade after knowing himself to be insolvent; and he failed to satisfactorily account for the deficiency of assets to meet his liabilities.

Granville Burgess, electrical engineer, Bury Street, London, E.C.—Release of trustee dating from September 1st.

Private Arrangement.—Venner's Electrical Cooking and Heating Appliances, Ltd., 66-68, Wandsworth Road, S.W.—At the adjourned meeting of the creditors herein, held last week, it was stated that the landlord, who had levied execution on the company's stock and office furniture and plant for over £300, for about two years' rent, payable in advance, had succeeded in his proceedings, although the liquidator had applied to the Court to restrain the landlord from distraining for the future rent. The Court held that as the distress was levied before the commencement of the liquidation the landlord was entitled to succeed. That took place last month, and since then the landlord had refrained from realising any of the assets in order to give an opportunity to the company of endeavouring to make some arrangement. At the previous meetings it was intimated that the directors were endeavouring to find additional capital. It was now stated, however, that up to the present the directors had not succeeded in making any definite arrangements, although certain negotiations were on foot. Since the last meeting an intimation had been received from an entirely different source that there might be some opportunity of selling the patents in another direction. It appeared that a petition had already been filed for the winding up of the company, but had since been withdrawn. The matter was discussed at some length, and resolutions were passed unanimously for the appointment of Mr. E. H. Hawkins, of Messrs. Poppleton, Appleby & Hawkins, of 4, Charterhouse Square, E.C., to act as the creditors' liquidator, in conjunction with Mr. Venner, the shareholders' liquidator. The latter stated that he was quite agreeable to the creditors appointing someone to represent them to act in conjunction with himself.

Neuhausen Aluminium. — According to a source closely associated with the Aluminium Industry Co., of Neuhausen, the condition of business of this Swiss undertaking is entirely satisfactory. The increasing use of aluminium during the course of the war has been stimulated by the seizure of metals in Germany, which has caused various industries to have recourse to aluminium as a substitute. The company, which is stated to have very large orders on hand for a long time forward, and which paid a dividend of 20 per cent. for 1914, reckons on very favourable results being obtained for the current year.

Trade Announcements.—The International Time Recording Co., Ltd., are removing to larger premises at 57, City Road, Finsbury, E.C., where they hope to be better able to cope with the increasing demand for Dey, Bundy, Rochester and International automatic time-recording machines.

Mr. Vernon Hill, electrical engineer, has opened new premises at 101, High Street, Broadstairs.

Book Notices.—"British Standard Specification for Electricity Meters." Report No. 37 of the Engineering Standards Committee, revised August, 1915. Price 7s. 9d., post free.—The Sub-Committee on Electrical Accessories, of which Mr. C. H. Wordingham is chairman, has been engaged on the revision of the first edition of this specification (issued in 1907) during the past 12 months, and has found it necessary to redraft it entirely, and to extend it considerably in consequence of the large increase, during recent years, in the size of individual installations arising from the extension of the use of electrical energy supplied from central stations. The first edition referred only to consumers' meters of sizes up to 100 amperes, but the revised report includes provision for meters up to the very largest sizes in use, as well as for three-wire and three-phase meters. It does not deal with electrolytic meters.

This specification is intended to apply to the purchase of new meters, governing their sale by the manufacturer to the purchaser, and has no direct bearing on any questions which may arise between the supply undertakers and their consumers in connection with such of the meters as are employed to register energy supplied from public supply mains. The requirements have, however, been so drawn up that meters conforming to them may reasonably be expected to fulfil the conditions imposed by the Board of Trade on meters used in connection with public supply undertakings, and to satisfy Inspectors under the Electric Lighting Acts during a considerable period after the meters have been put into service.

Some important modifications and additions have been made to the standards and definitions. It has now become necessary to distinguish between the portion of the main circuit in the meter and the portion outside the meter. This is done by defining, in addition to the definitions of "Main circuit" and "Pressure circuit," the "Meter current circuit" and "Meter pressure circuit."

The standard sizes of meters include sizes for currents up to 5,000 amperes. The registering mechanism is dealt with at some length, and the terms used to distinguish the different types of counting mechanism are "Pointer type" for the ordinary clock face with a rotating pointer, and "Counter type" for the so-called cyclometer mechanisms. In the latter case it is specified that the figures shall spring quickly into position, except the lowest figure used. The term "Register" is used and defined as follows:—"The term register denotes the circular scales and pointers, or the figure openings and figure wheels, as the case may be, from which are read the figures that permit evaluation of the supply to the consumer."

The limits of error are specified in a concise table, the formula used in the first edition of this specification having been discarded. Meters are required to have the testing constant plainly marked, and this constant is specified as the number of revolutions per minute which the rotor should make at the full load of the meter under standard temperature conditions.

Clauses have been added dealing amongst other things with the internal and external shunts, and resistances, pressure and current transformers, and the marking of the terminals of three-phase meters. Appendices have been added dealing with the precautions to be taken in the erection of meters, and notes on the testing of meters. Illustrations of typical arrangements of meter registers have also been added.

The report may be obtained direct from the offices of the Committee, 28, Victoria Street, Westminster, S.W.

"Calendar of the Royal Technical College, Glasgow," for the session 1915-16, commencing September 28th, 1915. Glasgow: The College.

"On the Relation of Imports to Exports." By J. Taylor Peddie. London: Longmans, Green & Co. Price 2s. 6d. net.

"*Proceedings* of the American Institute of Electrical Engineers, Vol. XXXIV, No. 9, September, 1915. New York: The Institute. Price $1.

"Classification of Alternating-Current Motors." By Val A. Fynn.—Reprint from the *Proceedings* of the American Institute of Electrical Engineers.

Catalogues and Lists.—General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C. — 8-page illustrated pamphlet (No. 1,921) briefly describing and giving prices of "Dubilier" portable X-ray apparatus, which can be easily carried from place to place and used direct on any normal electric lighting circuit.

Messrs. S. R. O. Ball-Bearing Co., 115, Southwark Street, London, E.C.—36-page illustrated catalogue and price list of the "S.R.O." ball-bearings of light, medium, heavy and special types. Particulars of bores, sizes, weights, working loads and prices are very fully detailed in some 30 pages of table matter.

Liquidation.—Spiral Regulating Dynamo Co., Ltd.—Creditors should send particulars of debts, &c., to Mr. H. C. Bound, 61 and 62, Lincoln's Inn Fields, London, W.C., the liquidator, by September 30th. A meeting is called for October 11th at that address to hear an account of the winding up.

LIGHTING and POWER NOTES.

Ashtead. — Street Lighting.—In reference to the tender for street lighting, the Council has been informed that the Gas Co.'s price was £3 per lamp, and that of the Electric Lighting Co. £2 18s. 9d. per lamp; there were already nine lamps fitted for electric light, which only required new lanterns, at a cost of about £8; they were therefore saving about £13 a year by accepting the Electric Light Co.'s tender.

Australia.—HYDRO-ELECTRIC SCHEME.—The project for utilising the water supply system of Grafton and South Grafton in connection with a hydro-electric power scheme, prepared by Mr. W. Corin, of the N.S.W. Public Works Department, has been submitted to the Minister. He reports that a new gravitational water supply for the two municipalities has recently been provided from the Nymboida river, by means of a tunnel half-a-mile long and a 22-mile pipe line. There is a fall of 200 ft. in the first mile or two on the Grafton side of the tunnel, and by leading a new power pipe line for this distance, it is estimated that without any considerable damming 300 KW. could be developed. The transmission would be overhead at 22,000 volts to Grafton and South Grafton, where energy would be sold in bulk to the municipalities at the rate of 2½d. per unit. The approximate cost of the hydro-electric installation and transmission line would be £23,000, whilst the distributing systems for Grafton and South Grafton would involve outlays of £4,300 and £12,000 respectively. It is estimated that with energy supplied in bulk at 2½d. per unit, and retailed by the municipalities at 6d. per unit for lighting, and 2d. per unit for power and street lighting, the expenses of the distributing systems would be covered.—*Commonwealth Engineer.*

ELECTRICAL PUMPING PLANT.—The electrical engineer to the Sydney Water and Sewerage Board, in his annual report, states that the 700-H.P., 5,000-volt induction motor driving centrifugal pumps at Crown Street continues to give good service. The cement-testing laboratory is fitted with electric heat baths. Motors for driving testing machines are also employed. The system of installing small centrifugal pumps, driven by electric motors, to automatically maintain the high levels full, has been extended. At Wollongong the electric power plant consists of a 45-KW., 2,200-volt, 50-cycle, three-phase generator, direct driven by a turbine at 1,000 R.P.M.; the head of 550 ft. under which the turbine operates is derived from the main supplying the town of Wollongong, and the electrical energy is transmitted to a 50-B.H.P., 2,000-volt motor-driven pump at the lower dam, a distance of about seven miles; the pump delivers water from the lower to the upper dam. At Richmond inquiries are being made with a view to adopting electric drive, as the capacity of the present steam plant, which is in need of a general overhaul, must be increased. A 100-H.P. compressing plant, driven by electric motors, has been put down near the Marrickville Railway Station, for the purpose of supplying compressed air to rock channellers and drills. Electric motors totalling 100 H.P. are being installed in connection with the rock-excavating plant at the new reservoir in Gladstone Park, Balmain. The number of electrically-driven pumping stations totals 31.—*Commonwealth Engineer.*

ANNUAL REPORT.—The first annual report of the Goulburn Council electric lighting undertaking shows a net profit of £1,275 after providing for depreciation and all expenses. It is proposed to install additional plant at an estimated outlay of £7,500.—*Tenders.*

Barnet.—STREET LIGHTING.—The North Metropolitan Electrical Power Distribution Co. has allowed the U.D.C. £39 in respect of diminished public lighting during the June quarter.

Brandon.—STREET LIGHTING.—The North Brancepeth Coal Co., contractors for public lighting by electricity, having had a sum deducted from their account owing to restricted lighting, have informed the U.D.C. that unless the balance is forthcoming they will be obliged to terminate their contract. The Council has decided to take no action in the matter, considering that the Council should not pay for energy not used.

Braintree.—PROPOSED E.L. SCHEME.—The U.D.C. has been informed that the canvass for prospective E.L. consumers has been favourable, but the matter will now have to stand over until the war ends. Mr. H. P. Girling, of Maldon, who undertook the canvass, is to be paid £40 out of £50 as agreed upon, and the balance when the report, delayed by the war, is completed.

Broughton.—E.L. SCHEME.—The R.D.C. has decided to offer no objection to the proposal of Wrexham T.C. to extend the electricity mains to the parish of Broughton.

Dartford.—PRICE INCREASE.—The U.D.C. has, owing to the extra cost of coal and other incidental expenses, increased from October 1st the charges for electricity as follows:—Lighting, flat rate, by 1d. per unit; ditto, alternative rates for long-hour consumers, by ½d. per unit; power, by ½d. per unit. Charges will be re-adjusted as soon as coal can be purchased at or near the rates in force before the outbreak of war.

Draperstown (Co. Derry).—PROPOSED E.L.—A meeting of ratepayers has appointed a Committee to report on the advisability of having the town lighted by electricity.

Dundalk.—The electrical engineer reports that the new storage battery at the power station is nearing completion. The six new cells erected recently as an extension of the battery were permanently connected last week. The first of the two new Diesel engines is about to be received from the makers. Several important connections have been made.

Hove.—PRICE INCREASE.—The Council has decided to increase the charges for electricity by 20 per cent. during the period of the war.

Ifield.—OVERHEAD LINES.—The P.C., which is about to install electricity in place of gas for public lighting, has applied to the Horsham R.D.C. for permission to erect standards in the parish for overhead lines. The Roads Committee has been deputed to consider the matter and report.

India.—The electrification of cotton mills in Bombay from the power supply of the Tata Hydro-Electric Works at Lonawla is rapidly proceeding, about a dozen mills having been connected at the end of last month. The Pearl and the Simplex Mills are the latest additions, both being designed for the electric drive. The Simplex is a spinning and weaving mill fitted with over 800 looms and 30,000 ring spindles; the whole of the machinery is driven by eight Westinghouse motors aggregating 1,300 B.H.P., with two transformer sets of 600 KW. each. The energy consumption is about 900 units per hour or 11,000 units per day, at 0·55 anna per unit; the annual cost to drive 30,000 spindles and 800 looms averages about Rs. 1,10,000 (£7,333).—*Indian Textile Journal*

Keighley.—PRICE INCREASE.—The Electricity Committee has decided to recommend the Council that, in view of the increased cost of production caused by the war, the scale of charges for direct-current electricity for lighting, motive power, heating and cooking purposes (but excluding electricity supplied in pursuance of existing sealed agreements) be increased by ½d. per unit from October 1st next inclusive.

London.—ST. PANCRAS.—The B.C. has received the consent of the Treasury to the borrowing from the Ecclesiastical Commissioners of such a proportion of the £22,530 as will be necessary to cover the cost of the two boilers at the King's Road electricity station, now approaching completion. The Electricity Committee recommends that a loan of £11,265, the amount required at the present time, be taken up. The Finance Committee recommends that the sum of £6,413, remaining in the net revenue account of the electricity department at March 31st last, after retaining £4,000 as a working balance, be utilised for the relief of the rates. The electricity reserve fund now stands at £44,160.

Milnrow.—The U.D.C. has decided to inform the owners of Coral Mill that it is not in a position at present to supply electricity.

Motherwell.—ANNUAL REPORT.—Mr. J. A. Wishart, burgh electrical engineer, reports that during the year there were generated 3,487,437 units, as compared with 3,620,089 units in the preceding year. Owing to restricted lighting there was a decrease in consumption of 82,171 units; power sales increased by 55,274 units. During the year 46 new installations were connected to the mains. The total income from all sources was £16,082.

New Earswick.—OVERHEAD LINES.—The Flaxton Council has again considered the question whether electric current should be conveyed to New Earswick by overhead or underground cables. Previously the Council had decided in favour of the latter, but the general manager of the York electricity department wished it to reconsider its decision, stating that only single poles would be erected, and these would be no more unsightly than ordinary telegraph or telephone poles. The Council decided to adhere to its previous decision in favour of underground cables.

New Zealand.—ANNUAL REPORT.—The report of the city electrical engineer, Dunedin, for the year ended March 31st last shows total revenue £57,627, and working expenses £18,799. After providing for interest £20,997, depreciation £3,825, and renewal fund £10,145, there was a net profit of £3,860. There were 10,999,608 units of electricity sold, as against 10,155,471 in 1914. The consumers numbered 5,015; the number of motors in use on the mains was 845 of 7,084 H.P., and the total generating and distribution costs per unit were ·402d. Average price obtained—for private lighting, 3·35d. per unit; power and heating, ·739d.; and for tramways, ·715d.

The Public Works Department is receiving many applications for the supply of current from the Lake Coleridge hydro-electric scheme. At Tai Tapu, 12 miles from Christchurch, a local butter factory is not only changing over to electric drive, but is undertaking the distribution of current on a co-operative basis to residences in the district. A larger flour mill is to be erected at Lincoln to be electrically driven; current is also to be supplied to the Lincoln Agricultural College. Negotiations are also in progress to supply current to Oxford, Hororata, and Cust, and other country towns. It is anticipated that the farmers will take advantage of electric power for carrying out farming operations as a means of cheapening production.—*Commonwealth Engineer.*

Peterborough.—PRICE INCREASE.—The Council has increased the price of energy for power purposes by ½d. per unit as from September 30th.

Runcorn.—PROV. ORDER.—The R.D.C. has been informed that the B. of T. has granted Warrington T.C. an order to supply electricity to the works of the Richmond Gas Stove and Meter Co., at Grappenhall, which are in the rural area.

Sandgate.—RESTRICTED LIGHTING.—The Folkestone Electricity Co. has allowed the U.D.C. a reduction of £210 from £486 due for public lighting as the rebate owing to restricted lighting. The Council considers the offer reasonable, but has asked for further adjustments on future accounts.

South Africa.—NEW ELECTRIC PLANT.—The annual report of the Government Mining Engineer of the South African Union, dealing with machinery, shows that during the year 1914 the chief items of new electrical machinery introduced were as follows:—Transvaal: Electric generators and engines, hoists,

locomotives and motors, £201,315; power cables, transformers bells, telephones, &c., £79,406. Cape Province: Electric generators and engines, hoists and motors, £25,642; power cables, transformers, bells, telephones, &c., £12,551. Orange Free State: Electric generators and engines, and motors, £4,819. There were 45 electrically-driven coal-cutters in use in the Union in 1914. The number of electric hoists licensed for the transport of passengers continues to increase; in the Transvaal, at the end of the year, there were in operation 103 induction-motor hoists, with an aggregate of 53,769 H.P., and 23 Ward-Leonard type hoists, with an aggregate of 25 575 H.P. Of the 162 elevators in the Transvaal which came under the supervision of the Mines Department, 157 were electric; in Cape Province there were 60 electrically-driven elevators; in Orange Free State 4, and in Natal 85 out of a total of 89. The number of units of electricity used for mining purposes was 451,988,177. There were nine separate accidents in connection with electric plant at the mines, classified as follows:—Direct contact with a live cable exposed through abrasion of the insulation, 3; contact with a conductor (signal wire), made live by its contact with a live cable exposed through abrasion of its insulation, 1; accidental contact with the insulated part of apparatus, (*a*) with live parts nominally exposed, 3; (*b*) with live parts nominally unexposed, but improperly exposed when live for adjustment, 1; misadventure, 1.—*S. A. Mining Journal.*

St. Anne's-on-Sea.—Out of a total of 321,191 units used up to July 31st, 44,290 units were for domestic power. This is a big increase compared with a year ago, when the figures were 28,180. The output of electricity for August showed an increased consumption, in spite of a reduction in public lighting, &c. The consumers now number 1,661, an increase of over 100.

Wakefield.—Loan Application and Price Increase—The City Council last week was informed that it was anticipated that there would be a deficiency on the electricity undertaking, and that the Local Government Board had refused to sanction any further loans for extensions of the works at present. The Electricity Committee, however, had decided to apply for sanction to borrow £1,000 to meet the cost of providing an additional boiler feed pump and a cooling tower at the works. With regard to the question of the price of electricity, the Committee recommended that the charges for power and lighting purposes be increased 12½ per cent. from October 1st.

Annual Report—The report of the city electrical engineer stated that during the past 12 months 3,132,262 units had been sold, whilst the number of consumers showed an increase of 88 at 1,025. There were 352 motors connected to the mains, with a total of 3,398 H.P. The revenue amounted to £18,055, and the expenditure to £10,856, interest and sinking fund charges absorbed £6,693, and there was a net profit of £506. It was estimated that the revenue of the undertaking would fall by about £900, on account of the reduction of lighting in the streets.

Wallasey.—Plant Extension.—The Council has sanctioned the expenditure of a further £9,000 for the installation of new plant at the electricity works.

Walsall.—As the new station and plant will not be in operation this year the Electricity Committee of the T.C. has decided to postpone work on the E.H.T. change over, and concentrate the staff upon the L.T. change over, *i.e.*, the laying of a third wire to 105-volt mains and the balancing up of 105-volt consumers on the three-wire system. The Committee has approved an extension of mains at an estimated cost of £180.

Windsor.—Street Lighting.—The electrical installation Co., Ltd., have again allowed the T.C. a rebate of £17 off the past year's account for public lighting. The Council, owing to the lighting regulations, has suggested that the present contract with the company be suspended, and that terms should be quoted for lighting on the reduced scale.

Worcester.—Mains Extension.—The Electricity Committee has decided to extend the mains in Hylton Road, at an outlay of £250, in order to supply electricity to Severn Bank tannery.

TRAMWAY and RAILWAY NOTES.

Ambleside.—Motor Vehicles.—The Council has refused the application of the Barrow-in-Furness Tramways Co., for licences for motor vehicles to ply in the district.

Ashton.—War Bonus.—An application from the tramwaymen's Union for a war bonus for tramwaymen working on the Manchester section has not been entertained.

Australia.—Suburban Railway Electrification.—When moving the second reading of the City and Suburban Electric Railways Bill in the New South Wales Legislative Assembly, the Minister for Public Works stated that the traffic was expanding so rapidly that it would practically double itself before the city railway had developed. During the last four years the train, tramcar and ferry traffic had increased 11·24 per cent. per annum, and at the same ratio would double itself in 6·5 years. Low level and high level underground schemes had been proposed, but the one before the House was what was known as the high level underground railway. It would be placed at a shallower depth than any of the other schemes.—*Aus Mining Standard.*

Birkenhead.—Female Labour.—Women conductors, all of whom are wives of soldiers, have been introduced on the Birkenhead tramways.

Bradford.—Female Labour.—A deputation from the Bradford branch of the Tramway Workers' Union met a sub-Committee of the Corporation tramways and the manager with reference to the employment of women on the tramways, the manager having publicly stated that owing to large numbers of enlistments from amongst his men there was difficulty in working the system properly. The deputation stated that the workers objected to the employment of women, maintaining that in Bradford, even more than in other places, owing to heavy gradients and "rush hours" which had no parallel on any other system, the work was unsuitable for females. There were plenty of men who had been rejected for military service, who could undertake the work better than women. As an organisation they objected to the idea until the necessity was proved. The tramway manager has indicated that he does not favour the employment of women if it can possibly be avoided.

Bristol.—Tramways Purchase.—With a view to enabling the negotiations with the company to be completed before finally making recommendations, the Tramways Option Committee has recommended the City Council to make application to the B. of T. for an order extending for one year the period during which the Corporation shall be entitled to exercise its present option to purchase the Bristol tramway undertaking. An order for an extension of time under the Act, if granted by the B. of T., will not affect subsequent periods for exercising the option of purchase.

Burton.—L.G.B. Inquiry.—A L.G.B. inquiry was held on the 7th inst. relative to the Corporation's application for a provisional order to run omnibuses and motor-cars within the borough. The borough electrical engineer expressed himself in favour of an electric 'bus to carry its own electricity, the capital expenditure for such a vehicle being about £1,200. It is proposed to have an experimental service with two or three cars at first.

Canada.—The Hamilton Hydro-Radial Union has been informed that the engineers of the Provincial Hydro Commission at work to the south of Hamilton are surveying for an electric line, not only from Hamilton to Port Dover and other points on Lake Erie, but for a line which will enter into competition with those of the Dominion Power and Transmission Co., as well as the steam road of the T. H. and B. The plans call for a hydro-radial to St. Catharines and all intermediate points, including a side line to Dunnville, Cayuga, &c.—*Canadian Engineer.*

Electric Railways.—The annual report of the Ottawa Department of Railways and Canals for the year ended June 30th, states that there are now 60 electric railways (including street railways) in Canada, aggregating 2,052·44 miles of single track. There are four railway systems, having over 100 miles of single track, viz., the British Columbia, 345 miles; Montreal Tramways, 234 miles; Toronto Railway, 133 miles; and the Winnipeg Railway, 101 miles. The passengers carried during the year numbered 794,059,593, and the car-miles run were 98,917,808. The total capital expenditure is returned at $147,595,342, and the year's net earnings were $7,867,546, and after various deductions for reserve, &c., the surplus was $1,873,955. On one-third of the lines there was a deficit on the year's working.—*Electrical World.*

London.—Women Conductors—The question of employing women as tramcar conductors in London has been put forward by the North Metropolitan Tramways Co., but the police authorities decline to issue licences.

North-Eastern Railway.—Heavy Freight Traction.—According to the *Yorkshire Post*, experimental working on the electrified portion of the N.E.R. from Shildon to Newport has commenced, and it is hoped that the whole length of the Simpasture branch, from Shildon to Erimus Sidings, Newport, near Middlesbrough, will be opened for traffic by the end of the month.

The starting point, Shildon, is the collecting ground for the West Durham coalfield, and practically the whole of the output carried over the line is intended to feed the enormous blast furnaces which are built beside the line at Erimus Sidings, between Thornaby and Middlesbrough.

Current is supplied by the overhead system, and conducted by two bows from the overhead conductor to the locomotives. Ten engines will be employed, nine of which are completed, and have made experimental runs. They are of the customary electric locomotive form, with a cab in the middle, with eight wheels, each pair of wheels having a separate motor. They have been designed by Mr. Vincent L. Raven, chief mechanical engineer, North-Eastern Railway, and built at the Darlington Works.

The electrical equipment has been designed and carried out under the supervision of Mr. Chas. A. Harrison, who has recently retired from the position of chief engineer of the company. The power is supplied by the Newcastle-on-Tyne Electric Supply Co., and the Cleveland and South Durham Companies, who have erected several sub-stations for the purpose, the pressure being 1,500 volts.

Nottingham.—Female Labour.—The City Council has decided to engage women to act as tramcar conductors, the difficulty of obtaining suitable men having become acute. Preference is to be given to young married women whose husbands are on active service or invalided home, and they will receive full rate of pay and uniform.

Southampton. — Female Labour. — The Tramways Committee of the Corporation proposes to employ women conductors during the continuance of the war, at a rate of pay of 5d. per hour, for, as far as possible, eight hours per day and six days a week.

Southport.—Annual Report.—The revenue from the tramways for the year ended March 31st last exceeded that of the previous year by £1,574, the total being £20 420.

Walsall.—Women Conductors.—The Tramways Committee is now employing females, to act temporarily as conductors, men being unobtainable for the position. They are being paid the same rate as men.

Women conductors are now engaged on the cars in Wolverhampton.

Wharfedale.—Railless Traction.—Last week the inauguration took place of the new railless route from the Guiseley terminus of the Leeds City tramways to Otley. The fare is to be 3d., and the charge from Otley right through to Leeds will be 8d.

Wigan.—Annual Report.—The report of the general manager of the Corporation tramways shows that the profit on the year's working was £902, as compared with £4,690 in the previous year; the traffic receipts were £75.248, a decrease of £2,726, and the working expenses £46,177. Interest on capital absorbed £13,866. and rent of leased lines £3,662; £13,101 was allocated to sinking fund and repayment of mortgage loans, and £4,231 was transferred to the renewal fund. The total car-miles run were about 1½ millions, and the receipts per car-mile were 12·07d., a decrease of 0·39d.; passengers carried numbered 13,811,709, a decrease of about half-a-million. The energy consumption was 1·461 units per car-mile. The total capital expenditure amounts to £481,577.

Female Labour.—Six women conductors were employed on the Martland Bridge Mill route last week.

TELEGRAPH and TELEPHONE NOTES.

Australia.—The Postmaster-General claims to have effected a saving of £25,000 by utilising scrap materials, such as metal pieces, &c., from old telephones in the departmental workshops. The material formerly largely went to waste.

Improvements in the telephone service are about to be adopted by the Postmaster-General, as the result of a general conference of telephone managers, on a report submitted by Mr. G. H. Morgan, telephone manager in Melbourne, and Mr. S. L. Monaghan, assistant telephone manager in Sydney, who recently toured America and Great Britain. Mr. Spence states that by the "attended-pay station" the caller is spared the delays and difficulties incidental to the penny-in-the-slot-system. It is specially adapted to busy centres, and is to be first tried at the central telegraph receiving office, Melbourne, and the General Post Office, Sydney. The "no delay trunk service" is a speeding-up process in the traffic between exchanges, workable on certain lines not more than 25 miles in length. It is also intended by the Postmaster-General to adopt a scheme, founded on that in existence in America, for the training of operators, and the practice of employing women operators on night duty is to be extended.

New Telephone Subscribers.—The Government has decided to impose a surcharge on new subscribers to the national telephone service. The impost came into operation on September 8th, and is intended to last during the war. It is, in fact, in the nature of a war tax, and will be applicable to the whole of the kingdom. Everybody requiring a new telephone service will be called upon to make an initial payment of £4. That is the minimum amount, and the sum may be exceeded if the installation is likely to entail much outlay. The surcharge is due entirely to the shortage of labour occasioned by the war, there having been, owing to enlistments and other causes, a considerable reduction in the number of men available for telephone extension. Under these circumstances the Postmaster-General is unwilling to undertake any new work which can be avoided. The object is to sift out applications and reject those which are not urgent, so that whatever money is spent may be used to the best advantage. The surcharge must be prepaid. On the installation being made, the ordinary tariff rates are enforced.

The Telegraph Service.—The Retrenchment Committee, of which the Chancellor of the Exchequer is chairman, has presented to the Government an interim report, in which it recommends economies in the public service which can be carried into effect at once and without legislation. The Committee considers that certain unremunerative Post Office services should be made self-supporting, and chiefly the telegraphic service, on which there is now a loss. If the recommendation is adopted by the Government, as it doubtless will be, the public may have 1s. telegrams again. Further, there is reason to believe that the Committee recommends that the low Press rates should be increased. It has been stated lately that the loss to the Post Office on this advantage given to the newspapers is £300,000 per annum.—*Daily News.*

The World's Wireless.—The 7,000 ship stations in the world require over 15,000 licensed men to operate them, while over 1,000 land stations with a working force of 3,200 men are required to handle the business which originates on board, or for, these vessels. The records of the United States show that about 2,000 amateurs have been licensed in the past few years to operate their own stations. All the best equipped warships carry wireless, and a fair estimate of the number of navy vessels at war so equipped is Great Britain 500, Germany 200, Italy 200, France 180, Russia 110, Japan 70, Austria 60. There are also a large number of small vessels under Colonial flags. The United States has over 300.—*T. and T. Age.*

United States.—The affairs of the United Wireless Telegraph Co. have been settled, after long litigation, and the company has been dissolved.—*T. and T. Age.*

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.— October 25th. Six electrically-operated wharf capstans, for the Sydney Harbour Trust. Forms of tender from the Engineer-in-Chief, Harbour Trust Offices, Circular Quay.*

October 25th. For the Commonwealth Department of Defence (Navy Office). Supply, delivery and erection of power-station plant and equipment for the Commonwealth Naval Dockyard, Sydney.*

Victorian Railways.—January 5th, 1916. Installation of automatic sprinklers and thermostats at Jolimont car-shed. Chief Storekeeper, Railway Offices, Spencer Street, Melbourne.

Bristol.—September 24th. Unwashed small coal for six or twelve months, for the Corporation electricity works. Mr. H. F. Proctor, Chief Engineer and General Manager, Exchange, Corn Street (returnable deposit of £2 2s.).

Burnley.—September 20th. B. of G. Electrical goods. Tender forms from Mr. J. S. Horn, Clerk.

Dundee.—September 27th. Heating and ventilating the City Hall Buildings, Dundee. Mr. Jas. Thomson, City Architect.

Edinburgh. — October 4th. Corporation. Cast-iron intake shaft, pump shaft, &c., for obtaining sea-water for condensing in connection with the new electricity station at West Bank, Portobello. The Engineer, Dewar Place station, Edinburgh.

Halifax.—September 22nd. Electrical fittings for six months for the B. of G. Mr. A. T. Longbotham, Clerk, Carlton Street.

London.—Bow.—September 21st. Electrical goods for the managers of the Poplar and Stepney Sick Asylum District. Mr. S. G. Wright, Clerk, the Asylum, Devon's Road, Bow, E.

Kensington.—September 23rd. Six months' supply of electric lamps and fittings for the B. of G. Mr. W. R. Stephens, Clerk, Guardians' Offices, Marloes Road, W.

H.M. Office of Works.—October 1st. Repair of incandescent electric lamps. See "Official Notices" to-day.

Liverpool.—September 21st. Electric supplies for six months, for the West Derby B. of G. Mr. H. P. Cleaver, Clerk, Brougham Terrace.

Manchester.—September 21st. Guardians of Manchester Union. New motor-driven compressor for refrigerating apparatus. Specifications from Mr. A. J. Murgatroyd, 23, Strutt Street, Manchester.

September 21st. Corporation Tramways Department. Supply and delivery, up to March 31st, 1916, of best house, furnace and anthracite coal. Mr. J. M. McElroy, 55, Piccadilly, Manchester. Also same date, (*b*) making up of uniform clothing, and (*c*) uniform caps.

Merthyr Tydfil.—September 21st. Electrical accessories for six months, for the B. of G. workhouse. Particulars from the Master.

New Zealand. — Dunedin. — November 3rd. City Council. Supply and delivery of insulated and bare copper wire in quantities for a period of two years. Specifications at Electrical Engineer's office, Market Street, Dunedin.—*New Zealand Shipping and Commerce.*

Shanghai.—September 24th. Municipal Council. One turbo-generator, 5,000 kw., and one or two of 10,000 kw., complete with condensing plant, &c. See "Official Notices" August 20th.

September 29th. E.H.T. switchgear, static transformers, and underground cables for 22,000 v., for the Municipal Council. See "Official Notices" August 27th.

South Africa.—Johannesburg.—October 9th. Municipal Council. Water-purifying plant with a capacity of 75,000 gallons per 24 hours, for the generating station.*

Spain.—September 30th. Registro de la Dirección-General de Telégrafos, Madrid. The construction and working, for a maximum period of 20 years of a central telephone exchange at each of the following towns: — Huesca (Province of Huesca); Lorca (Province of Murcia); Orihuela (Province of Alicante); Borjas

Blancas (Province of Lérida); and Aguilas (Province of Murcia). A copy of the *Gaceta*, containing particulars (in Spanish) regarding the installation of the necessary plant and material, may be consulted by United Kingdom manufacturers of telephone exchange equipment at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

Swindon.—September 18th. Corporation. Supply of steam coal. See "Official Notices" September 3rd.

Warrington.—September 22nd. B. of G. Electrical goods ("none of German or Austrian origin") for six months ending March 31st, 1916. Mr. Arthur Bottomley, Clerk, Bewsey Chambers.

September 28th. Twelve months' supply of earthenware conduit, for the Electricity Department. See "Official Notices" to-day.

Whittingham.—September 20th. County Asylum. Supply during six months, commencing October 1st, 1915, of various workshop stores. Mr. H. E. Morgan, Clerk and Steward.

Wolverhampton.—September 21st. Electric fittings for six months for the B. of G. Mr. F. Harrison, Clerk.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Australia.—The following contracts have been placed:—

P.M.G.'s Department, Victoria.

Item 1, one accumulator battery, Premier type, Perth, £340; item 2, ditto, South Australia, £345; item 3, ditto, Flinders Island, £305; item 4, ditto, Queensland, £305.—Warburton, Franki, Ltd.

Victorian Railways Department.

Carbons for arc lamps, £46 10s. per ton.—Aust. General Electric Co.
Kenti insulated wire: item 1, No. 14, solid, £43 5s. per mile; item 2, No. 8, stranded, £95 7s. 6d. per mile; item 3, No. 6, stranded, £115 10s. per mile.—R. W. Cameron & Co., Ltd.
One 30-kw. Silvertown shunt-wound generator complete, £138 10s.—L.-R., G.-P. & Telegraph Works, Ltd. —*Tenders.*

West Australian Government Tender Board.

Metallic-filament lamps: item 1, 2s. each; item 2, 1s. each; items 3, 4, 5 and 6, 11½d. each.—C. Atkins & Co. —*Aust. Mining Standard.*

Aylesbury.—The U.D.C. has accepted the tender of Mr. Thos. Robinson, of Liverpool, for installing the electric light at the Town Hall, at £129.

London.—Messrs. Siemens Brothers Dynamo Works, Ltd., have received an acceptance of a tender for the supply of Wotan lamps to the G.P.O. for the ensuing six months.

The G.P.O. has also placed a contract for Royal Ediswan drawn-wire lamps.

The General Electric Co., Ltd., has for the seventh time received the G.P.O. (six-monthly) contract for Osram drawn-wire lamps. The company has also received contracts for many thousands of Osram and Robertson lamps for the Admiralty and the War Office.

St. Pancras.—The Electricity Committee reports the purchase of the following supplies of coal, in accordance with the B. of T. suggestions:—

1,000 tons Nuneaton D.S. nuts, at 22s. 6d. per ton, from Messrs. Facers and Co., and 1,000 tons Newdegate nuts, at 22s. 7d. per ton, from Messrs. J. H. Beattie & Co., Ltd., for replenishing stock.
1,000 tons Newdegate beans, at 21s. ton; 500 tons ¾-in. Hacknall, at 19s. ton, and for the deficiency in quantities necessary to be made up over the next nine months.
2,000 tons D.S. Newdegate beans, at 21s.; 1,000 tons D.S. nuts, at 22s. 6d.

Bethnal Green.—The Guardians have accepted the tender of Pope's Electric Lamp Co., Ltd., for 700 metal-filament lamps, at 1s. 3½d. each; and the tender of Messrs. Drake & Gorham, Ltd., for 300 tantalum lamps for £19 8s. 6d.

Stretford.—The tender of Messrs. Belliss & Morcom has been accepted by the Electricity Committee for the supply and fitting of new valves for the intermediate cylinders of the engines of the last 500-kw. set, at an approximate cost of £70.

Sunderland.—Last week the T.C. accepted the following tenders on behalf of the Electricity and Lighting Committee:—

E.H.T. switchgear and meters.—Ferranti, Ltd.
Cable.—B.I. and Helsby Cables, Ltd.
Transformer oil.—E. Cleaton Rees.
Cable.—L.-R., G.-P. and Telegraph Works.

Walsall.—The tender of Messrs. H. Gough & Son has been accepted by the T.C. Electricity Committee, at £455, for internal alterations to the sub-stations.

Weymouth.—The T.C. has accepted the tender of Messrs. R. Cox & Son for 100 service boxes, at 9s. each.

FORTHCOMING EVENTS.

Institute of Metals—Friday, September 17th. At 8.30 p.m. At the Chemical Society's rooms, Burlington House, W. Annual general meeting.

Iron and Steel Institute.—Thursday and Friday, September 23rd and 24th. At the Institution of Civil Engineers, London. Autumn meeting. For particulars see our "Notes," September 3rd, p. 308.

NOTES.

Women Conductors.—At the Birmingham Police Court, one Joseph Judd was fined 20s. for removing the chain of a tramcar after it was full, and for rudeness to the woman conductor in charge of the car. The woman burst into tears in consequence of his offensive behaviour. The Bench signified its determination to protect women conductors, but the other passengers on the car had already shown that if need be they were prepared to take the law into their own hands.

Electricity in Steel Works.—The new electrical plant recently installed in the works of the Central Steel Co., at Massillon, Ohio, U.S.A., has given every satisfaction, as is evidenced by the statement of the directors of the company that the "Electrically operated steel mills may be considered a success." The installation was due to the efforts of the Massillon Electric and Gas Co., who succeeded in convincing the Central Steel Co. that their new steel mills should be electrically equipped, and the result is that electric power is employed exclusively in the operation of this plant. After six months' work the superintendent reports that the capacity of the plant is 30 per cent. greater than that at which it was rated, and "the very first run of steel was marketed and pronounced of satisfactory quality." He also adds that the effectiveness of the electrical installation in reducing labour costs has exceeded all expectations. The mill of the Central Steel Co. has at present a capacity of 400 tons of steel per day, but four additional furnaces are to be erected immediately, and these also will be electrically equipped throughout.

The New York Electrical Exhibition.—Arrangements are well in hand for the ninth annual Electrical Exposition and Motor Show, which is to be held at the Grand Central Palace, New York, from October 6th to the 16th. The Exhibition will, it is expected, surpass those of former years in interest, as the U.S. Government, including the Army, Navy, and Treasury Departments, and the New York City Board of Education, are uniting in an effort having this object in view; in addition to which all the leading electrical engineering and allied concerns will be present with exhibits. As regards the Army, this department will be represented by an exhibit prepared at the Springfield Arsenal, showing the manufacture of rifles and sabres. The Signal Corps of the Eastern Division of the Army will also have a display of the communication apparatus used by a modern army in the field, including wireless telegraph, telephone, and various other signalling devices.

By direction of the Naval Department, an exhibit is being prepared, comprising a 5-kw. wireless sending and receiving station and the central generating station of a Dreadnought. The U.S. Treasury is sending an interesting exhibit—a "Money Laundry," a machine for washing, drying and ironing paper currency.

Among the industrial exhibits of interest will be a dairy and a bakery, all the apparatus and machinery in connection with which will be electrically worked. The American Telephone and Telegraph Co. is arranging to give a series of demonstrations of the trans-Continental telephone line between New York and San Francisco, in connection with which brief lectures will be given on the development of the telephone and the construction of the trans-Continental line itself. The New York Edison Co. will have, among other interesting exhibits, a therapeutic display, including a model hospital and clinic, with every modern electric appliance used in surgery and the treatment of diseases. In addition, between 75 and 100 different firms have booked space at the Exhibition.

New Source of Platinum.—Most of the world's supply of platinum comes from the Russian deposits in the Ural Mountains, the average output being about 9 tons a year, while only about 300 kg. is derived from other sources. The total supply has remained practically constant since 1900, but the price has more than doubled during the past 10 years, owing to the increasing demand for platinum in the chemical, electrical, and dental industries, and to the control exercised by a company. Moreover, the richest Russian deposits are gradually becoming exhausted.

The high price of the metal has prompted prospectors to search for new sources, but their efforts have generally proved unsuccessful. However, at Wenden, in Westphalia, according to the *Génie Civil*, in the course of explorations for ores of iron, lead and copper, the presence of platinum has been unexpectedly discovered in proportions such that the deposits appear to be amongst the richest in the world. A cubic metre of the new ore contains as much as 36 to 70 grammes of the metal, compared with a content averaging 6 to 8 grammes in existing mines, and rarely exceeding 40 grammes. The discovery was due to a new method of chemical analysis, which was capable of detecting platinum not only in the free state, but also in the form of alloys with other metals such as silver, which being soluble in nitric acid would have passed without detection under the old methods of test. This fact encourages the hope that platinum may be found in other regions of similar geological formation to that of Wenden. The Austrian publication from which our contemporary derives this information, however, observes that the presence of exploitable platinum in Germany has not been fully proved.

Educational.—South-Western Polytechnic Institute.—The prospectus of the day and evening courses for 1915-16 has come to hand. Classes are provided in the usual engineering subjects, under Mr. A. J. Makower and his assistants in electrical engineering, Messrs. U. A. Oschwald and B. H. Morphy.

Strike of Dublin Electricians.—On Tuesday last, says our Dublin correspondent, all the members of the Dublin Union of Electricians struck work, and electrical work in the city was consequently brought to a standstill. The trouble arose out of the demand of the men for payment of 11d. per hour, the prevailing rate being 9½d. per hour. The employers refused to accede to the demand. Roughly, there are about 30 electrical firms in the city. Non-Union men remained at work, and some of the masters say they can proceed without the aid of those who have gone out. The Corporation electricians are not affected by the strike, there being an agreement under which they must remain at work during a local strike; but the Corporation is bound by whatever agreement as to terms may be come to by outside employés and employers. About 200 of the men on strike have left for Belfast and Glasgow. Several important contracts have had to be refused by city firms within the past few months, owing to the scarcity of electricians, numbers having gone to cross-Channel centres for munitions work. An instance has been quoted of a junior hand who, some time ago, was earning 25s. per week in Dublin, and is now getting £5 in another city. Some of the Dublin employers have advertised for men to fill the places of the strikers.

Mr. J. Gibson, secretary of the Dublin Building Trades Employers' Association, writing to the Press on behalf of the electrical section, states that the Electrical Trades Union (Dublin branch) came to an agreement with the Association in May, 1914, under which they were to receive 9½d. per hour for 50 hours per week, resulting in a weekly wage of 38s. 6½d., "which is as high as paid to any skilled worker in Dublin or district, with one exception." "The conditions of the electrical trade in Dublin since the war started are," says Mr. Gibson, "extremely bad, work being scarce and many employers finding it almost impossible to pay expenses. It has further to be borne in mind that the rate of wages in Dublin is as high as paid to any electricians in the United Kingdom with, we believe, one exception, viz., London. The increase demanded by the men amounts to 7s. 3½d. per man per week, equal to practically 20 per cent. When the men demanded this increase of wages we offered to consider the question of a bonus to men engaged on war work, but no notice was taken of this offer."

Volunteer Notes.—Engineering Institutions' Volunteer Training Corps.—

Company Orders.—By Lieut.-Col. C. B. Clay, V.D., Commandant, for week commencing September 20th, 1915:—

Drills, 6.30-7.30; 7.30-8.30, p.m.

Monday.—Section 3, Technical instruction; Section 1, musketry at range; Sections 2 and 4, Squad drill or signalling.

Friday.—Section 4, Technical instruction; Section 2, musketry at range; Sections 1 and 3, Squad drill or signalling.

Attention is called to the fact that the War Office has now decided to employ certain Volunteer Training Corps in guarding waterworks, railways and prisoners.

3rd Batt. (Old Boys) Central London Regiment (Volunteers).—Battalion Orders by Colonel S. G. Grant (Officer Commanding), Thursday, September 16th, 1915:—

Week-end Parade.—Sunday.—The Corps will be visited by General Sir O'Moore Creagh, V.C., G.C.B., G.C.S.I., on Sunday next, the 19th inst. The Battalion will parade as strong as possible at Liverpool Street Station (low level entrance G.E.R.), at 9.30 a.m., for entrenching, returning about 4.55 p.m.

The Quartermaster will make the necessary arrangements for refreshments to be served on the grounds.

Regimental Sports.—Owing to the large number of entries for all the events in the Regimental Sports programme, it is absolutely necessary that all preliminary heats for the 120 Yards Handicap, and the Pole and Pillow Fight, should be got through in the morning on Saturday next, commencing at 11 o'clock sharp.

The order of the printed programme will be carried out as far as possible. Competitors not answering to their names at the time at which each of them starts will be scratched.

No. 10 Inter-Company Push Ball is cancelled. Another event will be substituted, should time allow.

Commissions.—There are a few vacancies for Commissions in the Royal Engineers (Kitchener's Army) open to members of the Corps who are engineers by profession. Age, 25-40 years. Members desirous of taking up these appointments are directed to apply to the Adjutant, at Headquarters.

Musketry.—There will be no Shooting at either Bisley or Acton Ranges on Saturday next, the 18th inst.

A. G. Joiner, *Major and Adjutant*, O.B.C.

Appointments Vacant.—Chief assistant clerk and accountant for Shanghai municipal electricity department (£46 per month); jointers (41s.) for H.M. Dockyard, Rosyth. Particulars are given in our advertisement pages.

The Electrical Photometry of Stars.—In a paper read at the meeting of the National Academy of Sciences, April 20th, 1915, Stebbins reviewed the recent work on this subject carried out at the University of Illinois Observatory. The majority of the work has up to the present been performed by the utilisation of the selenium bridge. This is mounted at the focus of the telescope, and the brightness of the illumination is indicated by the consequent diminution of resistance, which is measured by a Wheatstone bridge. The selenium bridge suffers from certain disabilities, the chief of which are that it is especially susceptible to temperature changes, and after exposure to light requires considerable time for recovery. However, it becomes more sensitive and extraordinarily more regular with decrease of temperature, so that for stellar work it is kept surrounded by an ice-pack, the whole apparatus being wrapped up in a blanket.

The selenium bridge bids fair to be displaced for such work by the photo-electric cell, which is more sensitive, and has a shorter recovery period. The photo-electric cell has a sensitive surface of one of the alkali metals, which is mounted in an exhausted glass vessel, with a small residue of inert gas. The effect of light is to release electrons from the surface, which ionise the gas, and thus a current is produced, the intensity of which is a measure of the incident light.—*Knowledge.*

Institution and Lecture Notes. — South African Institution of Engineers.—At the annual general meeting of the Institution, Mr. W. Ingham was elected president, and Messrs. Bernard Price and E. G. Izod vice-presidents. The Institution passed a resolution offering its services to the Government of South Africa for investigating proposals of a technical nature for the benefit of the Empire.

Train Lighting.—Commenting upon the recent train smash at Newark, the *Yorkshire Post* remarks "the very small casualty list is, undoubtedly, a great support for the advocates of electricity as against gas for the illumination of railway coaches. The greater part of the express was electrically lighted, and there was consequently no fire as a sequel to the smash. In almost all the railway accidents of recent years it has been the resulting fire which has been responsible for the worst horrors. The promptitude and presence of mind of the cook in shutting off the gas supply in the kitchen is particularly commendable."

Fires Due to Air Raids.—The British Fire Prevention Committee's Air Raid "Warning" as to the nature of the bombs used and how to deal with fires arising therefrom, which was first published earlier in the year, is now being re-issued in the form of a small poster, which can be obtained gratuitously upon written application (with stamped and addressed large envelope enclosed), from the Registrar of the British Fire Prevention Committee, 8, Waterloo Place, London, S.W. The "Warning" gives hints in simple, direct language as to explosive bombs, incendiary bombs, pungent fumes, and simple methods for meeting outbreaks of fire. It is illustrated with particulars of the incendiary bomb generally used by the enemy.

A Resourceful Lineman.—The foreman of construction in an Arkansas town a few days ago, after the flood had prostrated all telegraph lines, was instructed to restore communication at all hazards and without an instant's delay. The foreman was resourceful. He chartered a lifeboat and started down the stream, which covered the roadway and fields. In the course of a short time he discovered that he was getting out of sight of land. He therefore returned and obtained a mariner's compass. He started out again, this time towing a raft of telegraph poles, ranging from 20 to 30 ft. in length. He took soundings at the first place he thought would be just about right to drive into the ground one of the poles. To his surprise he found 53 ft. of water. He then proceeded further, and in a short time he discovered that he was out of sight of land. An inland lake 200 miles in extent had been formed by the flood waters. Under these conditions the foreman, not to be dismayed, returned to headquarters and sent an urgent message ordering 100 miles of submarine cable and a cable steamer to be sent by rail to lay the cable.—*Telegraph and Telephone Age.*

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—At St. John's Church, Preston Park, Brighton, on September 6th, the marriage took place of Mr. Geo. Fredk. Hilton, assistant engineer at the Ipswich Corporation electricity works, and Miss Kathleen Mary Agate, eldest daughter of the late Mr. J. Agate, of Brighton. The presents included an oak and silver biscuit box from the Ipswich electricity staff.

Mr. George Varey has been appointed chief assistant at the Wakefield electricity works during the war; an extra remuneration of £25 per annum is to be paid to him for the additional duties he will be called upon to perform.

Mr. R. E. Livesley has been appointed shift engineer at the municipal electricity works, Stretford, in place of Mr. T. Woodhill, resigned.

Mr. A. E. Wilson, deputy city electrical engineer, Bristol, has resigned his appointment, he having been appointed by the War Office to the position of electrical engineer to the Chief Engineer of the Southern Command. The Electrical Committee recommends the City Council (1) to promote Mr. A. J. Newman, who has been in the service of the Committee for 11 years, to the vacant position, at a salary of £350, rising to a maximum of £400; (2) to promote Mr. A. J. Ostler, who has been in the Committee's service for 14 years, to the position of sub-station engineer, at a salary of £200, rising to a maximum of £250; and (3) to promote Mr. I. A. D. Pedler, who has a record of 15½ years' service, to the position of mains engineer, at a salary of £175, rising to a maximum of £250. The Committee is also of opinion that it is desirable, owing to the large increase in the size of the undertaking, to appoint a boiler-house superintendent whose duties will be chiefly to supervise the combustion of coal with a view to further economy in steam raising, and recommends such appointment at a salary of £200 per annum.

General.—We regret to learn that Mr. J. C. White, of the St. Helens Cable and Rubber Co., Ltd., was operated on for appendicitis last week. He is now, however, out of danger and progressing satisfactorily. Mr. White is the inventor of the patent corrosion-proof fittings that have acted as valuable accessories to C.T.S. wiring in severe situations.

On the occasion of his marriage to Miss Norah Harding Moss, daughter of Mr. Wilfred Moss, of The Knolls, Nanpantan, Loughborough, Mr. Wm. Pearson, of the staff of the Brush Electrical Engineering Co., has been presented by his colleagues with a case of cutlery.

The marriage took place at the parish church, Harpenden, Herts., on Sept. 6th, of Miss Winifred Mary Down, elder daughter of Mr. F. J. Down, M.I.E.E., of Glengariff, Harpenden, and Mr. Selwyn Dudley, younger son of the late Rev. H. T. Dudley, vicar of Whitfield, Glossop.

We regret to learn from the *Ironmonger* that M. Adolphe Greiner, of Liége, president of the Iron and Steel Institute, is seriously ill, suffering from an internal complaint. On September 1st news reached this country of an improvement in his condition.

Mr. George Dawkes, who has been appointed controller of the Telegraph Department, General Post Office, Edinburgh, in succession to Mr. Wm. Smith, who retired in May, has had a wide and varied experience. In 1874 he joined the service as a telegraphist at Leamington Spa, afterwards going to Brighton. His next appointment was to the North-Eastern surveyor's district, and later he became chief superintendent at Leeds. He was afterwards transferred to London as assistant traffic manager in the secretary's office.

Mr. W. C. P. Tapper, M.I.E.E., manager of the Stepney electricity undertaking, is a member of the London Munitions Committee.

The *Commonwealth Engineer* states that Mr. A. Fraser, electrical engineer, Sunbury, Vic., has been appointed second engineer at the new power house, Canberra, N.S.W. Mr. M. C. Henderson, assistant electrical engineer to the Dunedin, N.Z. Council, has been appointed city electrical engineer in succession to Mr. E. E. Stark. Mr. G. T. Edgar, who was employed in the electrical engineer's office as draughtsman, has been appointed assistant electrical engineer.

The *Review of the River Plate* states that Engineer Alvarez Cortes has been appointed manager of the State electric power stations of Uruguay.

It is announced in the Press that Temporary Lieut.-Colonel George R. H. Bowden, Royal Fusiliers (City of London Regiment), has relinquished his temporary rank on vacating command of a battalion.

Mr. Edwin C. Flint, who for the last nine years has held the position of senior estimator in the cable sales department of Messrs. Siemens Bros. & Co., Ltd., Woolwich, has resigned to take up a position with Messrs. Pirelli-General Cable Works, Ltd.

Roll of Honour.—Charles Cooper, of the Royal Naval Division, who was 34 years of age, and formerly worked at the Salford Corporation electricity station, has died from wounds received in the Dardanelles.

Lance-Corpl. Christopher Mooner, of the 11th Manchester Regiment, who has been killed at the Dardanelles, was employed by the Broughton Copper Co., Salford, and was in training as an electrical engineer.

Trooper Arthur Bibby, of the Life Guards, formerly in the electric traction department of the L. & Y. Railway, is recovering from the effects of gas poisoning, and is now at Birchington-on-Sea Convalescent Hospital.

Private Alex. McLaren Doig, of the 6th Manchesters, who has died from wounds received at the Dardanelles, was for four years a student at the Manchester School of Technology, and in 1912 received the Manchester University certificate of distinction in electrical engineering.

Private John W. Hogg, of the Signal Section, Royal Engineers, formerly a linesman employed by the Warrington Post Office, has met a tragic death while engaged on the repair of a telephone line. Capt. Mitcheson, in a letter to his father, states that Private Hogg went out to improve the telephone line which had been laid on the previous day. For some distance this line ran under some high-tension electric power lines. Hogg climbed up one of the poles with the telephone wire in his mouth, obviously to put it higher up on the pole, and, not realising that the wires above him were power wires, placed his left hand on one of them. He was killed instantaneously. Capt. Mitcheson pays a high tribute to the work of the deceased, and states that he was the hardest working and the most cheerful and willing man in his section. Private Hogg was 23 years old.

Private Edward Moss, of the South Wales Borderers, formerly employed by the Tudor Accumulator Co., Ltd., Dukinfield, is reported missing, and it is feared that he was drowned in the sinking of the *Royal Edward*.

Private R. Higham, a former employé at Messrs. Dick, Kerr and Co.'s works, has been wounded in the Dardanelles whilst with the Loyal North Lancashires.

Lance-corporal Baker, of the 5th Essex regiment, a member of the Chelmsford Town Council, who has been killed in action, was for many years employed at the Arc Works of Crompton & Co., Ltd., and latterly at the Marconi Works. When war broke out he became medical officer's orderly.

Private Victor E. Clarke, 1-6th Manchester Regiment, who has been killed in action in the Dardanelles, was on the staff of the Old Trafford Dynamo Co., of Manchester, which he joined after being trained at the works of Davey, Paxman & Co., of Colchester. He joined his regiment on September 7th, and proceeded a week later to Egypt for training.

Sergeant E. D. Wharldell, of the 11th Battalion Manchester Regiment, who was on the staff of the National Electric Supply Co., of Preston, has been killed in action in the Dardanelles.

Sergeant-Bugler Walter Henry Slaughter, of the 4th Sussex Regiment, who has been killed at the Dardanelles, was engaged at the Worthing Corporation electricity works prior to the war.

Troop-Sergeant Sydney Gordon Kerry, of the Berks Yeomanry, who was on the staff of the Reading E.L. Co., has been wounded in action in the Dardanelles. At first he was reported to have been killed.

Private Clifford Hitchcox, who was formerly in the test department of the British Thomson-Houston Co., Ltd., of Rugby, has been killed in action. He was serving with the Canadian Contingent.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Tilling-Stevens, Ltd. (formerly W. A. Stevens, Ltd.).—Issues on various dates from November 25th, 1913, to August 31st, 1915, of £50,000 first mortgage debenture stock, part of a series of which particulars have already been filed.

Chamberlain and Hookham, Ltd.—Capital, £100,000 in £5 shares (10,000 pref.). Return dated April 15th, 1915. 10,000 ord. and 8,000 pref. shares taken up. £5 per share called up on 7,298 pref.; £36,490 paid; £53,510 considered as paid on 10,000 ord. and 702 pref. shares. Mortgages and charges: Nil.

Contraflo Condenser and Kinetic Air Pump Co., Ltd. (110,264).—Capital, £80,000 in £1 shares. Return dated April 12th, 1915. All shares taken up. 7s. per share called up on 27,000; £9,450 paid; £53,000 considered as paid on 53,000 shares. Mortgages and charges: Nil.

Lawson's Non-Conducting Composition, Ltd.—Capital, £10,000 in £5 shares (1,600 ord., 100 defd., and 300 pref.). Return dated May 18th, 1915. 1,211 ord., 118 pref., and 100 defd. shares taken up. £5 per share called up on 889 shares; £4,445 paid; £2,700 considered as paid on 540 shares. Mortgages and charges: Nil.

CITY NOTES.

Nairobi Electric Power and Lighting Co., Ltd.

In submitting the accounts for 1914, the directors add the following comparative figures:—

	1912.	1913.	1914.
Units generated	604,392	728,852	1,020,038
Customers connected at December 31st..	508	610	633
Motors connected, B.H.P.	248	373	422
Private lights connected (8-c.p. equiv.)	10,658	13,745	22,808
Street lighting	2,000	2,000	2,000

The schemes for the utilisation of the Thika Falls, for which tenders were received and necessary financial arrangements made, had to be stopped owing to the outbreak of war. The Treasury prohibition of new capital issues being most stringently applied when it is a question of using the same outside the United Kingdom, has also effectively stopped the company's schemes. Sanction was, however, obtained for the issue necessary to provide the auxiliary steam plant to be erected at Nairobi to prevent the inconvenience which would be caused to the community by complete stoppage of the development of the company's undertaking.

Two of the directors were called up for war service, viz., the managing director, Lieut.-Commander R. C. Bayldon, R.N., and Colonel A. W. Mayo-Robson, A.M.S., in consequence of which the board elected their consulting engineer, Mr. E. W. Monkhouse, to be a temporary director of the company.

Southern Electric Tramways (Buenos Ayres).—The report for the year ended June shows a credit balance, after depreciating plant and machinery by 10 per cent., of $87,364, to which had to be added $23,293 brought forward. The sum of $1,747 is transferred to reserve and $4,368 to contingency account, after which a dividend of 2 per cent. is declared and $20,565 is carried forward.—*Financial Times.*

Direct Spanish Telegraph Co., Ltd.—The board has decided to pay, in addition to the dividend at the rate of 10 per cent. per annum on the preference shares, an interim dividend at the rate of 4 per cent. per annum, free of income-tax, on the ordinary shares, both for the half-year ended June 30th, 1915.

South Metropolitan Electric Light and Power Co., Ltd.—The transfer register and register of debenture stock-holders will be closed from September 18th to October 1st, 1915, for the preparation of warrants for the half-year's interest, payable on the 1st prox., on the 4½ per cent. first debenture stock.

Manila Electric Railroad and Lighting Corporation.—A dividend of 1½ per cent. for the quarter ended September 30th, on common capital stock, is announced.

Dundee, Broughty Ferry and District Tramways Co.—The directors' report for the year ending July 31st states that the profit (including the sum brought forward from last year), after providing for interest on debenture stock, amounts to £3,599. From this is deducted the interim dividend paid on preference shares for the half-year to January 31st at the rate of 6 per cent. per annum, less tax, £1,354, leaving £2,244. The directors propose to pay the final dividend on the preference shares at the rate of 6 per cent. per annum for the half-year ending July 31st, less tax, £1,334; to renewal fund £400; to sinking fund for the redemption of debenture stock, £400; to carry forward £109. During the year a portion of the company's line, 1,540 yards in length, was acquired by the city of Dundee, under compulsory powers.

Dumbarton Tramways Co., Ltd.—Mr. Geo. Balfour, chairman, in moving the adoption of the report at the annual meeting, said that the directors regarded the result of the year's working as satisfactory. The total receipts from traffic and advertising amounted to £23,304, being a decrease of £259. Receipts from interest on deposits and temporary loans and transfer fees were £45 less than last year. Traffic and power expenses had increased by £340, and general expenses by £44; but, on the other hand, maintenance expenses showed a decrease of £485, due to the large expenditure made during the previous year. The report was adopted and dividends on the preference shares at the rate of 6 per cent. per annum for the half-year, and on the ordinary shares at the rate of 1½ per cent. for the year, in each case under deduction of income-tax, were approved.

Halifax and Bermudas Cable Co., Ltd.—A dividend of 3 per cent., free of income-tax, is announced for the half-year, making 6 per cent. for the year, carrying £10,049 forward.

Holophane Co., Ltd.—The net profits for the year to June 30th were £7,309, plus £11,623 brought forward, which, according to the *Financier*, is to be carried forward.

International Light and Power Co., Ltd.—The directors have declared a dividend of 1½ per cent., less British income-tax, on the preference shares for the quarter ending September 30th.

British Aluminium Co, Ltd. — The directors have decided to pay a six months' interim dividend at the rate of 6 per cent on the preference shares.

STOCKS AND SHARES.

Tuesday Evening.

The strength of the Stock Exchange markets is well maintained. Plain indications of increased taxation in the near future have little of the effect which, in normal times, is associated with such reminders of national obligation. In peace days, the hint that income-tax is to be raised is sufficient to force down the prices of gilt-edged securities, which, in their turn, drag down a host of others. But taxation in these days is different from what our generation has been accustomed to in the past; and the call to further self-sacrifice which such hints imply is accepted with something almost like readiness, even by those who wonder how they are going to stand it.

American exchange problems are likely to be straightened out in the very near future by the issue of a one hundred million pounds sterling loan in the United States by the British Government, but this factor New York has allowed to become overshadowed by the fresh diplomatic difficulties that have arisen between America and Germany. These difficulties our cousins seem to take much more seriously than we do over here, where the opinion is as strong as ever that Dr. Wilson will not allow his country to be dragged into anything likely to lead to open rupture. If the Americans could tamely submit to the sinking of the *Lusitania* and accept the "explanations" Germany offered therefor, she will be capable of sitting down under any sort of insult or injury, however flagrant. This, at least, is a fair summary of much City opinion; and the London Stock Exchange declines to suppose that the present incidents will end in anything stronger than hot air.

Meanwhile, events in Mexico and in Brazil are being watched with keen attention, since it is held that the latter country is struggling gamely through its troubles, and that even in Mexico the hopes of settlement need not be postponed indefinitely. At the same time, there is not much consolation to be drawn from the reported attitude of Carranza as to the futility of further peace negotiations at present. The British Consul at Mexico City has forwarded a complete list of the bonds and other securities which were removed from the vaults of the Mexican National Treasury by the Carranzist forces when they occupied the capital last February. These securities are believed to have been deposited at Vera Cruz. The list is now available for inspection at the Commercial Intelligence Department of the Board of Trade, 73, Basinghall Street, E.C. It embraces the names of a very large amount of securities, with the numbers of the bonds concerned; so if any readers are unfortunately interested in this matter, they should put themselves into communication at once with the department.

One of the features of this week is the pronounced recovery in various of the steam railway stocks. Started by a rally of a couple of points in Brighton Deferred, the improvement spread to the rest of the list. The Brighton Company has just inaugurated a new system of third-class Pullman cars, and it is thought that this enterprising step, and the publicity given to it, have directed attention to the low price of the stock. The London and South-Western Preference issue, made primarily for the purpose of providing funds for the electrification of the suburban lines, has braced up to 100. Underground Electric Income bonds had a quick rise of 1½, and Metropolitans and Districts are both better.

This change in the aspect of the market has come about in spite of the new agitation on behalf of the railwaymen, in which some of the authorities who cannot as a rule be accused of championing the cause of labour, have recognised a certain amount of justification. With the railway business of the country in the hands of the Government, the idea is that dividends are not likely to fluctuate to any material extent. Some ten weeks' dividends have now accrued in the prices of the Home Railway stocks; and, as this is the "fat" half of the year, Home Rails are being recommended as good investments to which can be safely entrusted, at all events, part of the money realised by the sale of American bonds, of which many thousands of pounds' worth have changed Continents within the last few weeks. The immediate outlook is hardly affected by the probability of another War Loan before the end of the present year; and it takes very little demand for stock to throw into relief the limited nature of the floating supply available to meet it.

The market for electrical supply shares is dull and heavy. There are a good many sellers about; some of them are anxious to get any sort of bid for their shares, this being the case, of course, where people are obliged to raise money. To quote one example: certain shares, nominally supposed to be 8½-9, were pressed for sale by a holder of 25, who insisted upon some sort of a bid being made him. The best offer he could get was 7¾, 15s. below the nominal price. We have used fictitious figures, but the company is one of the best in the Metropolitan list. Meanwhile, prices are not put down to any noticeable extent. For City Ordinary there are a few buyers, and the quotation has hardened to 12½.

In the manufacturing group, the principal change is one which cannot be traced in our lists. British Insulated Wire have been extremely difficult to sell for months past, but within the past day or two a buyer has been about, prepared to give 10¾, or a little more. The inquiry no doubt is stimulated by the increase in the interim dividend, which is taken to forecast an advance upon the present good rate of 15 per cent. At the current level, the shares pay just over 7 per cent. on the money, without taking into account the possibility of improvement.

Anglo-Argentine Tramways have receded after their recent recovery. The Preferences are both lower, but the 4 per cent. Debenture stock at 73 is the turn better, following upon its rise of 1½ last week. In the Mexican issues there is still next to nothing going on. Mexico Tramways first gold bonds last changed hands about 39¾, earlier in the month; and the Seconds within the last few days have been done at 36½. Rio Tramway bonds are more active about 88, the 5 per cent. second bonds keeping about 71. The Home Tramway descriptions are quiet. British Electric Traction 5 per cent. Debenture stock was bought the other day at 79, and 63 was paid for the 4½ per cent. second Debenture stock.

Canadian Utilities have been moving sharply in price as the American Exchange rose and fell. Canada is represented on the Financial Commission now assembled in New York to consider the establishment of a credit on behalf of the Allies. The prosperity of the United States industrial companies is described as "almost scandalous" by some of their own participants in the money now being made; and there is a good deal of inquiry for most Canadian issues. Canadian General Electric Common, however, is somewhat neglected at about 107, the Preference having been done recently at 108½. Vancouver Power 4½ per cent. Debenture stock was picked up at 62 a few days back, and Shawinigan Water changed hands on Monday at 122, there being also a little demand for the company's 4½ per cent. Perpetual Consolidated Debenture stock in the neighbourhood of 87½. Consolidated Gas and Electric Light of Baltimore Common stock is good at 108.

Activity is developing more and more in the shares of the Victoria Falls Power Company, and this week the price of the Preference has spurted to 17s. 3d., the Ordinary rising simultaneously to 5s. 6d. The 5½ per cent. Second Debentures are changing hands between 86 and 87. Added to a decided revival in Kaffir shares has been the turning off of the tap in Victoria Falls Preference which has had the effect of keeping the price depressed for some time past. Whether all the shares have been taken or not we cannot say, but a great many were absorbed just lately, and have gone into good hands.

The Telegraph market is slightly erratic. Great Northerns are £2 down. Eastern Telegraph Preference shed 4 points. Eastern Ordinary is a little lower, but Anglo-American Deferred at 21¾ is ¼ up. Marconis are a quiet, rather uninteresting market. Americans, after being 15s. 6d., recovered a few pence, but Canadian Marconis remain dull at 5s. 9d. New York Telephone 4 per cent. rallied to 98½, on the fall in the American Exchange. It is difficult to see how these can be worth holding by British investors, who have greater attraction offered them, in the way of security and interest, in home-grown stocks and shares. On Direct Spanish Ordinary shares, an interim dividend of 4 per cent. is declared, and on Globe Ordinary the usual quarterly payment of a florin will be made at the end of this month.

The rubber share market is scarcely so animated as it was at the end of last week, when dealings were on quite a healthy scale. Supplies of the raw material are arriving in bulk, and these no doubt tend to keep down the price of the produce. But the companies as a whole are doing well. The armament group is better again; and in copper shares a slightly improved tendency became noticeable upon American buying of some of the favourite copper properties.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend, 1914.	Price Sept. 14, 1915.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.				
Brompton Ordinary	10	7½	—	£6 13 4
do. 7 per cent. Pref.	7	7½	—	4 16 7
Charing Cross Ordinary	5	3⅝	—	6 13 4
do. do. do. 4½ Pref.	4½	3⅝	—	6 0 0
do. do. City Pref.	4½	3⅝	—	6 0 0
do. 4 Deb.	4	80	—	5 0 0
Chelsea	5	4½ xd	—	5 17 8
do. 4½ Deb.	4½	88	—	4 17 10
City of London	9	12½	+ ½	7 7 0
do. do. 6 per cent. Pref.	6	10⅝	—	5 11 4
do. do. 5 Deb.	5	100	—	5 0 0
do. do. 4½ Deb.	4½	85	—	5 6 0
County of London	7	10½ xd	—	6 16 7
do. do. 6 per cent. Pref.	6	10½ xd	—	6 0 0
do. do. 1st Deb.	4½	90	—	5 0 0
do. do. 2nd Deb.	4½	85	—	5 6 0
Kensington Ordinary	9	6⅝	—	7 4 0
London Electric	4	1⅝	—	8 8 4
do. do. 6 per cent. Pref.	6	4½	—	6 6 4
do. do. 4 Deb.	4	80	—	5 0 0
Metropolitan	5	3½	—	7 0 0
do. 4½ per cent. Pref.	4½	3⅝	—	6 0 0
do. 4½ Deb.	4½	90	—	5 0 0
do. 3½ Deb.	3½	70	—	5 0 0
St. James' and Pall Mall	10	6⅝	—	7 8 2
do. do. do. 7 per cent. Pref.	7	6½	—	5 12 0
do. do. do. 3½ Deb.	3½	70	—	5 0 0
South London	5	2⅞	—	6 19 0
South Metropolitan Pref.	7	1⅞	—	6 14 0
Westminster Ordinary	9	6⅝	—	6 18 4
do. 4½ Pref.	4½	4½	—	5 9 0
Telegraphs and Telephones.				
Anglo-Am. Tel. Pref.	6	98	—	6 2 6
do. Def.	1½	21⅜	+ ⅛	6 18 0
Chile Telephone	8	6½	— ½	6 3 0
Cuba Sub. Ord.	5	8½	—	6 1 8
do. Pref.	10	15	—	6 13 4
Eastern Extension	7	11⅜	—	*6 17 0
do. 4 Deb.	4	79	—	5 2 1
Eastern Tel. Ord.	7	115	—1	*6 18 0
do. 3½ Pref.	3½	66	—4	5 6 0
do. 4 Deb.	4	81	—	4 19 0
Globe Tel. and T. Ord.	6	9⅜	—	*7 0 8
do. Pref.	6	9⅞	— ½	6 3 0
Gt. Northern Tel.	22	33	—2	6 13 4
Indo-European	10	50	—	6 10 0
Marconi	10	1⅜⅜	—	5 5 3
New York Tel. 4½	4½	99½	+ ½	4 11 7
Oriental Telephone Ord.	10	1⅜⅜	—	5 8 1
do. Pref.	6	1⅜	—	5 6 8
Tel. Egypt Deb.	4½	80	—	5 0 0
United R. Plate Tel.	2	5⅛	—	*8 6 6
do. Pref.	5	4⅞	—	5 2 7
West India and Pan.	1	1⅜	—	8 17 9
Western Telegraph	7	11¾	—	*6 17 0
do. 4 Deb.	4	81	—	4 16 5
Home Rails.				
Central London, Ord. Assented	4	71	—	5 12 1
Metropolitan	1½	24½	+ ⅜	5 2 0
do. District	Nil	14½	+ ½	Nil
Underground Electric Ordinary	Nil	1⅜	—	Nil
do. do. "A"	Nil	5/9	—	Nil
do. do. Income	6	72	+1½	*9 10 8
Foreign Trams, &c.				
Anglo-Arg. Trams, First Pref.	5½	32	— ½	7 6 8
do. 2nd Pref.	5½	8½	— ⅛	8 9 2
do. 4 Deb.	4	73	+ ½	5 9 7
do. 4½ Deb.	4½	72	—	6 5 0
do. 5 Deb.	5	74	—	6 15 2
Brazil Tractions	3½	47	—	7 9 0
Bombay Electric Pref.	6	10½	—	5 17 1
do. 4½ Deb.	4½	87	—	5 3 0
Mexico Trams	Nil	33	—	Nil
do. 5 per cent. Bonds	—	40	—	Nil
do. 6 per cent. Bonds	—	85	—	Nil
Mexican Light Common	Nil	25	—	Nil
do. Pref.	Nil	30	—	Nil
do. 1st Bonds	—	40	—	—
Adelaide Sup. 6 per cent. Pref.	6	5	—	6 0 0
do. 5 Deb.	5	98	—	5 2 0
Manufacturing Companies.				
Babcock & Wilcox	14	2⅜⅛	—	6 8 5
British Aluminium Ord.	5	1⅜⅛	—	4 11
do. Pref.	6	18/6	—	6 9
British Insulated Ord.	15	10⅝	—	7 1 2
do. Pref.	6	5⅞	—	5 2 2
British Westinghouse Pref.	7½	32/6	—	9 7 6
do. 4 Deb.	4	68	—	5 14 4
do. 6 p. lien	6	101	—	5 19 0
Callenders	15	11	—	6 16 4
do. 5 Pref.	5	4½	—	5 11 3
do. 4½ Deb.	4½	92	—	4 17 9
Castner-Kellner	15	8½	—	4 13 6
Edison & Swan, £3 pd.	Nil	11/-	—	Nil
do. do. fully paid	Nil	1	—	Nil
do. do. 4 Deb.	4	58	—	6 18 0
do. do. 5 % Deb.	5	60	—	8 6 8
Electric Construction	6	13/-	—	9 4 8
do. do. Pref.	7	19/-	—	7 7 4
Gen. Elec. Pref.	6	9⅛	—	6 6 4
Henley	20	14	—	*8 8 3
do. 4½ Pref.	4½	4½	—	5 0 0
do. 4½ Deb.	4½	92	—	4 17 9
India-Rubber	5	8⅝	—	5 14 8
Telegraph Con.	20	31	—	7 15 0

* Allowance made for dividends being paid free of income-tax.

Direct West India Cable Co., Ltd.—A dividend of 3 per cent., free of income-tax, is announced for the half-year, making 6 per cent. for the year, carrying forward £63,319.

British Insulated and Helsby Cables, Ltd.—The directors announce an interim dividend of 5 per cent. actual on the ordinary shares on account of the current financial year.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, September 15th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric per cwt.	..	..
a „ Nitric „	..	..
a „ Oxalic per lb.	1/-	..
a „ Sulphuric per cwt.	..	..
a Ammoniac Sal „	£49	..
a Ammonia, Muriate (large crystal) per ton	£40	..
a Bleaching powder „	£9	..
a Bisulphide of Carbon „	£23	..
a Borax „	£23	..
a Copper Sulphate „	£28	..
a Lead, Nitrate „	..	..
a „ White Sugar „	..	..
a „ Peroxide „	..	..
c Methylated Spirit per gal.	..	..
a Potassium, Bichromate, in casks per lb.	8½d.	..
a Potash, Caustic (88/90 %) per ton	..	..
a „ Chlorate „ per lb.	1/4½	..
a „ Perchlorate „	1/6	..
a Potassium, Cyanide (98/100 %) „ (for mining purposes only)	Nom.	..
a Shellac per cwt.	65/-	..
a Sulphate of Magnesia per ton	..	..
a Sulphur, Sublimed Flowers „	£11 10	..
a „ Recovered „	£8	..
a „ Lump „	£8 10	..
a Soda, Caustic (white 70/72 %) „	..	..
a „ Chlorate per lb.	1/3	..
a „ Crystals per ton	45/-	..
a Sodium Bichromate, casks per lb.	5d.	..
METALS, &c.		
b Aluminium Ingots, in ton lots per ton	..	..
b „ Wire, in ton lots (1 to 14 S.W.G.) „	..	..
b „ Sheet, in ton lots „	..	..
g Babbitt's metal ingots „	£50 to £221	..
c Brass (rolled metal 2" to 12" basis) per lb.	1/1 to 1/1½	½d. to ¾d. dec.
c „ Tubes (solid drawn) „	1/1 to 1/1½	..
c „ Wire, basis „	1/1 to 1/1½	..
c Copper Tubes (solid drawn) „	1/1½ to 1/1⅝	..
g „ Bars (best selected) per ton	£98	..
g „ Sheet „	£98	..
g „ Rod „	£98	..
d „ (Electrolytic) Bars „	£83	£1 10 dec.
d „ „ Sheets „	£101	£1 10 dec.
d „ „ Rods „	£90	£1 10 dec.
d „ „ H.C. Wire per lb.	11d.	½d. dec.
f Ebonite Rod „	8/-	..
f „ Sheet „	2/6	..
a German Silver Wire „	1/10	..
h Gutta-percha, fine „	6/10	..
h India-rubber, Para fine „	2/4½	..
l Iron Pig (Cleveland warrants) per ton	64/10	3½d. dec.
l „ Wire, galv. No. 8, P.O. qual. „	£26	..
g Lead, English Pig „	£24	15/- inc.
g Mercury per bot.	£16 15	10/- dec.
e Mica (in original cases) small per lb.	4d. to 2/6	..
e „ „ „ medium „	3/- to 5/-	..
e „ „ „ large „	6/6 to 10/6 & up.	..
g Nickel, sheet, wire, &c. „	Nom.	..
g Phosphor Bronze, plain castings „	1/1 to 1/3½	..
g „ „ rolled bars & rods „	1/2 to 1/3½	..
g „ „ rolled strip & sheet „	1/3½ to 1/6½	..
e Platinum „	185/-	..
d Silicium Bronze Wire per lb.	1/3	..
r Steel, Magnet, in bars per ton	£85	£5 inc.
g Tin, Block (English) „	£154	£1 10 inc.
n „ Wire, Nos. 1 to 16 per lb.	2/7	..
g White Anti-friction Metals per ton	£52 to £194	..
k Zinc, Sh's (Vieille Montagne bnd.) „	Nom.	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
l Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

Electro-Bleach and By-Products, Ltd.—Mr. H. J. Mackinder, M.P., presiding at the annual meeting held at Manchester on September 9th, said that the company did not commence manufacturing until January. During the eight months of this year an interim dividend had been paid, which told the meeting that, in the directors' opinion, they had not worked at a loss, but they had had difficulties. He was not certain whether it was fortunate to be the successors of a bankrupt company, because the public was very slow to come forward under such circumstances. The company was struck by the war before the payment of capital was completed. The last call was not made until last October; every penny had now been paid up.—*Financier.*

Liverpool District Lighting Co., Ltd.—An interim dividend at the rate of 4 per cent. per annum for the past half-year is announced.

Stock Exchange Notice.—The Committee has ordered the under-mentioned to be quoted in the Official List:—

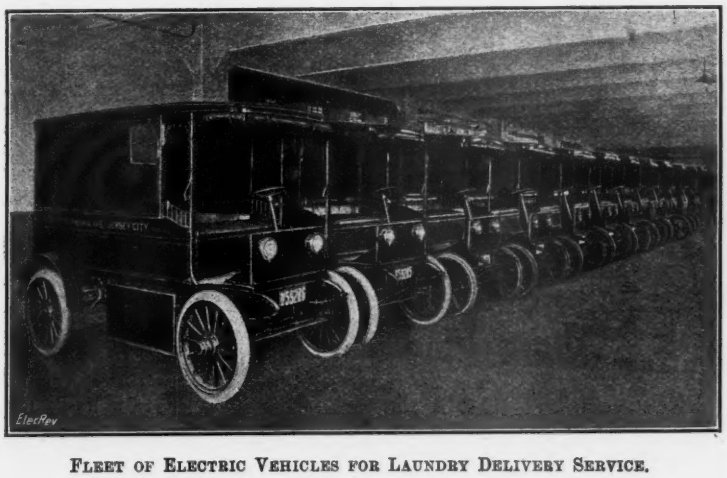
Metropolitan Railway Co.—£500,000 5 per cent. preference stock.

ELECTRIC VEHICLES IN LAUNDRY SERVICE.

That the electric vehicle is especially adapted to house-to-house delivery and other transportation requirements demanding frequent stops is indicated by the fact that American department stores, bakeries, breweries, laundries, &c., have adopted its use on a large scale. In fact, the largest transportation delivery fleets in the world are chiefly composed of electric vehicles. It is significant that these fleets are a result of repeated orders extending over a period of 10 to 15 years. The following is a table of some of the largest electric fleets in the United States :—

Ward Baking Co.	610	
Adams Express Co.	326	in two cities
American Express Co.	220	" "
Jacob Rupert	145	
George Ehret Brewery	136	
Commonwealth Edison Co.	114	
New York Edison Co.	130	
Gimbel Brothers	119	
Carson, Pirie & Scott	67	
Marshall Field Co.	230	

One reason why electric vehicles compose such a large percentage of big transportation fleets is that large and successful organisations usually approach their transportation problems upon a practical engineering basis. Unfortunately thousands of smaller concerns and individuals buy motor delivery wagons with but a small conception of their suitability for a particular service.



Fleet of Electric Vehicles for Laundry Delivery Service.

The Electric Vehicle Association, U.S.A., while promoting the sale and use of electric vehicles for all purposes, is also conducting investigations with a view to ascertaining lines of business particularly suited to the electrics. As soon as these applications become thoroughly known, the operating costs and other data are systematically distributed to users in that class.

One of the industries that has been under examination by the Association for some time is the laundry business. In no other delivery service can the electric be applied to better advantage than in laundry work. Not only are its inherent reliability, simplicity of operation, and cleanliness, features which every laundry delivery service should have, but also its satisfactory performance and economy of operation in a house-to-house delivery are points which should appeal strongly to the clear-headed business man. A successful user of electrics is the Brunswick Laundry, of Jersey City.

The proprietor states that he is "fully convinced that the electric is the very best thing for house-to-house delivery. After three years' experience, during which time we have added to our fleet gradually, so that we now operate 18 electrics, with two more on order, I feel that I have had ample opportunity to observe the results of electric delivery service and compare them with other methods of delivery. We bought our first electric three years ago, and it gave such excellent results, that when the time came to enlarge our equipment, I decided to dispose of our horses and wagons, and buy electrics." . . . "The 18 electrics have not only done the work of the 40 horses which I formerly owned, but also take care of unusually heavy increase in business."

"I operated my electrics under this plan, at a general average of $10 a month per car. As my electric delivery wagons averaged 20 miles per day during this period and figuring on 300 working days to the year, it will be noted that the cost for current per mile was about 2 cents. As for repairs bills, I find that they are a negligible quantity in electric vehicle operation. I have paid just $16 for repairs on our first electric, which we have used constantly for over three years, and that was for new chains and sprockets. Compare this slight expense with the bills for wagon and harness repair, horse shoeing, veterinary service, &c. We are saving something over $600 a month by operating electrics. The initial cost is, of course, comparatively large, yet when the extreme longevity of the electric—10 to 15 years or more—is considered, the cost per year is very low. In addition, I consider the advertising value of the electric in the laundry business worth considerably more than the interest would be on the initial cost."

"The batteries which we use in our electrics are the nickel-iron type, and although the manufacturer guarantees them for four years, I am counting on getting about eight years out of mine."

"Tires, I find, will last from 1½ to two years on an electric. The average life of the tires on the six gasoline trucks which we use for very long hauls is from three to four months. As some one has said, an electric never wears out."

"Our electrics make on an average 25 miles per day, visiting all the outlying suburban districts. Some of our best drivers deliver as many as 900 bundles per week and make an average of 32 miles per day. . . . . During the most severe snowstorms last winter our electrics made their usual number of trips in the same average time. There is something about the powerful motor of an electric that enables it to plough right through the snow which no gasoline truck, in my experience, has been able to do as well. Several times our gas cars were stalled and had to be towed in. . . . . The same men who had been driving our horses, and had probably never touched the steering wheel of any automobile before, learned to operate the electrics in a little more than a day. . . . . I am fully convinced that for laundry delivery service the electric is the most efficient and economic vehicle."

FIELD TELEPHONES.

By CHARLES R. DARLING.

(*Abstract of paper read before the* Royal Society of Arts, *July 28th*, 1915.)

In this greatest of all wars, the combatants on both sides find that the telephone is an indispensable adjunct in the conduct of operations in the field. By its aid communication is established between the various units, guns are fired according to orders conveyed by telephone from the battery observer, and in nearly all cases where it is necessary to keep two or more stations in touch the telephone is used. Flag signalling, being too conspicuous, has practically been abolished; and the present war has rightly been termed a "telephone war."

The telephones to which we are accustomed in civil life are unsuited to military operations for two reasons. First, they lack portability; and, secondly, they are not provided with a means of transmitting messages by Morse code in the event of speech being inaudible. It has, therefore, been necessary to design special instruments for use in the field.

The usual arrangement of parts in field telephones follows on the lines indicated in fig. 1. The primary circuit consists of a battery, B, connected to the primary winding of an induction coil,

P, and to the vibrator or buzzer, V, through the key, V K. The microphone or transmitter, M, is placed in parallel with the buzzer, and may be brought into the circuit by means of the key, M K. The secondary circuit consists of the receiver, R, one end of which is connected to line and the other end to the secondary winding, S, of the induction coil, which in turn is joined to earth through a condenser, C. The arrangement at the other end of the line is identical with the foregoing, and to establish communication the operator at either end connects the line to the terminal L, and attaches the terminal E to an earth-pin driven into the

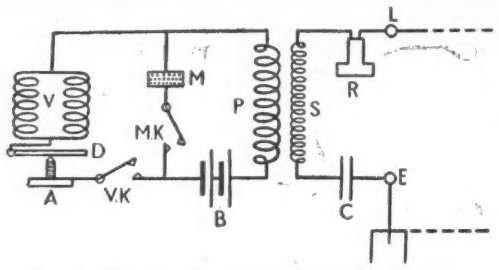


Fig. 1.—Typical Circuit of Field Telephone.

ground. In different forms of field telephones this circuit is modified in various ways. Most modern instruments possess a third terminal, placed between the condenser and the secondary winding of the induction coil, so that the condenser may be cut out or brought into the circuit as desired. In the Stevens telephone the induction coil serves to operate the buzzer; in the Service instrument, known as the "D Mark III," the buzzer windings perform the functions of the induction coil, and a second receiver, inserted in parallel with the first, is provided. The circuit shown in fig. 1 may, however, be regarded as the fundamental type upon which the others are based.

In the regulation Service telephone the battery consists of two "dry" cells, of external dimensions $3\frac{3}{4} \times 1\frac{1}{2} \times 1\frac{1}{2}$ in., connected in series.

Operation. Two cells in series used.	Current (amperes).	Useful life of cell.	Final voltage.
Using simple buzzer ...	0·2—0·3	15 hours	1·2 or less
Using polarised buzzer...	0·1—0·15	25–30 „	„
Speaking through microphone	0·2—0·4	12 „	„

Frequent renewal of cells is necessary when the telephones are in active use. The best clue to the condition of a cell is furnished by the readings of a voltmeter placed across its terminals, and any cell showing a less figure than 1·3 should be replaced by a new one. Voltmeters used for this purpose should be of the moving-coil pattern, and capable of reading accurately to $\frac{1}{10}$ volt.

The induction coil used in field telephones is usually 2 to 3 in. long. The resistance of the primary winding is about 0·5 ohm when used with a simple buzzer, and about 3 ohms when in conjunction with a polarised buzzer, as in the "D Mark III." The secondary winding possesses about 30 times as many turns as the primary.

The buzzer or vibrator serves the double purpose of acting as a call-up, and also as a means of transmitting messages by Morse code. In the simple form, the action is identical with that of an ordinary electric bell. Referring to fig. 1, the buzzer V is seen to consist of two windings, through which the current from the battery divides. These windings are provided with iron cores (not shown in the drawing), and the path of the current is continued through the iron armature D, and the adjusting screw A. When a current passes through the windings, the cores are magnetised, and attract the free end of D, thereby drawing it away from A and breaking the circuit. The cores then lose their magnetism, and the armature springs back and renews contact with A, thus restoring the circuit. The rapid to-and-fro movement of D gives rise to a buzzing sound, whence the arrangement derives its name. As the buzzer is in circuit with the primary of the induction coil, every make and break of the current caused by the vibration of D will give rise to an induced current in the secondary, which, passing through the line circuit, acts on the receivers so as to reproduce the note emitted by D. The key, V K, is used as a Morse key for the purpose of sending messages, a long contact representing a "dash," and a short contact a "dot."

The objection to the simple buzzer described, which is used in the Service "D Mark II" field telephone—now becoming obsolete—is that the note lacks sharpness, and is not suited to the rapid transmission of messages. In the Stevens field telephone the core of the induction coil, which becomes magnetised when a current passes through the primary, is used to attract the armature, a plan which simplifies construction by dispensing with the separate buzzer coils. A polarised buzzer, such as will be described later in connection with the "D Mark III" telephone, is preferable to a simple buzzer, as it requires less current to work and gives a sharper note.

For economy of weight and space, the receivers of field telephones are made in the "watch" form, wound with coils of combined resistance about 200 ohms. For convenience of rewiring, the terminals are, or should be, placed on the exterior of the case.

The microphone or transmitter consists of a replaceable capsule contained in a metal case, the top of which screws on to the lower portion, and holds the capsule in position. The capsule contains a carbon block, with cavities in its upper surface, which are filled with small spherical granules of carbon. Touching the granules is a carbon disk, protected from moisture by a covering of mica. When in use the current from the battery passes through the granules, and when the carbon disk is vibrating, the area of contact at this part of the circuit is constantly changing. This results in changes in the strength of the current, and, as the primary of the induction coil is in the circuit, induced currents are produced in the secondary and its connections, which cause the diaphragm of the receiver to vibrate in unison with the disk of the capsule.

Although not essential to the transmission of sounds, a condenser, inserted in the line circuit, is a useful adjunct to a field telephone. It is made up of alternate sheets of tin-foil and paraffined paper, and possesses a capacity of $\frac{1}{30}$ to $\frac{1}{40}$ microfarad. A condenser, whilst stopping the passage of direct currents, permits alternating currents to pass through, although somewhat impaired in strength. Owing to this property, a pair of field telephones, with their condensers in circuit, may be attached to an existing telegraph line, and messages sent without interference. The direct currents used in telegraphy cannot pass through the telephones owing to the condenser; the alternating currents due to the telephones do not affect the telegraph instruments; and hence both operations may proceed simultaneously. This fact is frequently taken advantage of in the field. It is also customary to use a condenser in the circuit when tapping a telephone line, as less current is then diverted through the instrument used for tapping, and the communication from end to end is not unduly interfered with. In the D Mark II telephone a condenser is permanently in the circuit; in more modern forms, such as the D Mark III, Stevens, and Siemens instruments, the use of the condenser is optional, and is only resorted to for the special purposes mentioned above.

The use of an earth return for a field telephone has the advantage of saving a second line, with the attendant trouble of laying out. Contact with the ground is secured by means of a pointed iron pin, about 14 in. long and $\frac{3}{4}$ in. in diameter, which is driven in to a depth of several inches. This pin carries a terminal, and is connected to the telephone by a short wire. In damp ground a pocket-knife, or even a wire inserted into the ground, gives sufficient contact. In dry, sandy ground it is difficult to secure a good "earth," and it is necessary to pour water round the pin. Should this fail, a return wire must be used.

In the D Mark III and Siemens telephones a metal base, permanently connected to the earth terminal, is provided, so that when placed on the ground an earth-pin is unnecessary. The International Electric Co. provide a special heel-plate, to which a wire from the telephone may be attached, so that a telephonist may use his instrument whilst walking.

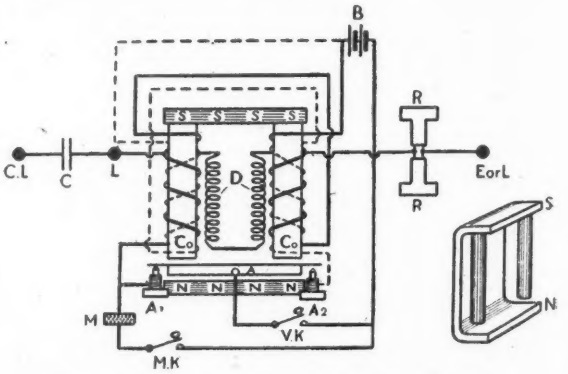


Fig. 2.—Circuit of D Mark III Field Telephone.

The Service D Mark II pattern was much used at the commencement of the war. It superseded an older and smaller form known as the Mark I, but is in turn being rapidly replaced by the Mark III. It possesses a simple buzzer, mounted with the induction coil on a fibre block. Beneath this are placed two dry cells, and a metal box containing two condensers, one of which is connected permanently to the line circuit, and the other placed across the buzzer terminals to diminish sparking at the contact with the armature. The microphone and receiver are connected by flexible copper wires to terminals on the top of the fibre block; and the whole is contained in a leather case provided with pockets for holding the microphone and receiver when not in use. The line and earth terminals protrude from the side; and a soft portion of the leather lid enables the buzzer to be worked without opening the case. A shoulder-strap is provided, and the total weight is about $5\frac{1}{2}$ lb. The circuit is identical with fig. 1, with the addition of a condenser between the armature D and the screw A.

The chief defects of the instrument are the unsuitable character of the buzzer for Morse signalling; the high current required to work the buzzer, which soon exhausts the cells; and the liability of the connecting cords of the microphone and receiver to breakage. It requires constant supervision to keep in order, and its complete withdrawal in favour of the D Mark III will be an unmixed advantage.

The special features of the D Mark III Telephone, which is the latest service pattern, are the use of a polarised buzzer, and the

arrangement by which the windings round the cores of the buzzer are made to constitute the induction coil. The circuit is shown in fig. 2, and at first sight appears complicated. The action of the buzzer resembles that of the polarised bell used in ordinary telephones, but whereas this bell is actuated by an alternating current, a direct current only is available for the buzzer. The same result is secured, however, by causing the battery current to pass alternately through each of two windings round the cores, which, being oppositely disposed, produce opposite magnetic effects. The iron cores, C_0, are mounted on the south pole, S, of a permanent magnet bent twice at right angles, as shown at the side of fig. 2. The lower extremities of the cores will therefore possess S polarity. An iron armature pivoted at its centre is placed between the ends of the cores and the N pole of the permanent magnet. The upper face of this armature has N polarity, and carries at either extremity a thin strip of steel. In the position of rest, one of these strips touches an adjusting screw A_1, the other being free of the screw A_2. Each core possesses two windings, one right-handed and the other left. On pressing the buzzer key, V K, the current flows through the armature to the screw A_1, and thence round the cores by the path indicated by the full line. This results in the S pole of the core opposite A_1 becoming strengthened, whilst that of the core opposite A_2 is weakened; and hence the armature is drawn away from A_1 and makes contact at the other end with A_2. The circuit completed by this contact is shown by the dotted line, and the effect now is to strengthen the S pole opposite A_2, and to weaken the other. Hence the armature leaves A_2, and again makes contact with A_1, and thus is set into rapid vibration. When the screws are properly adjusted, so as to make the throw of the armature even on both sides, a keen, sharply-defined note is obtained, suited in every respect to calling-up or rapid Morse signalling. This buzzer requires a minimum current of 0·1 ampere for satisfactory working, this being only about one-half that needed for a single buzzer. A better result is thus secured, with less current, and consequent extension of the life of the battery.

The secondary of the induction coil, D, shown in the drawing at the sides of the cores, is wound over the buzzer coils, and every make or break of contact between the armature and the screws results in the production of an induced current in the secondary circuit, which, passing through the line and receivers at both ends, produces a response to the note of the buzzer.

The microphone, M, is connected so that when its key, M K, is pressed the current passes through the full-line winding of the buzzer cores, which then serves as the primary of the induction coil, the fluctuations in current caused by speaking into the microphone resulting in induced currents through the secondary circuit as in the case of the buzzer.

Two receivers, B, are used, joined to the same terminals. The terminal marked L or E is connected to a metal plate at the base of the instrument, which serves as earth contact. The condenser, C, is placed between the terminals L and C L, and is only in the circuit when the line is connected to the latter.

The instrument consists of two compartments, provided with lids, the taller containing the cells and the lower the buzzer and condenser. On the lower lid are mounted the buzzer key, terminals for the two receivers and microphone, marked B and M respectively; and also three terminals lettered L, C L, and L or E, for connection to line and earth. The buzzer itself is fastened on the under side of the lid, and the condenser is at the bottom of the compartment. One of the two receivers is contained in a leather case provided with a head-strap, so that it may be fastened to the ear when awaiting a call, leaving both hands free. The other receiver forms the upper part of a hand combination, which may be telescoped into a small size for packing; the lower part being the microphone, the key of which is in the handle. For transit, all the parts are placed in a leather case, 8½ in. × 4 in. in plan, and 6½ in. high, to which a shoulder-strap is attached. The total weight is a little over 8 lb.

The use of two receivers is a distinct advantage. If the cords of one should break the other may still be used, and the line circuit remains intact. A very important message may be heard simultaneously by two men, the risk of misinterpretation being thereby greatly reduced. Further, one of the receivers may be detached and re-wired if necessary, without putting the telephone out of action. The clear note of the buzzer is of great value, as Morse code messages are frequently the only means of communication in the firing line, talking being inaudible. The only weak point is the tendency of the connecting cords to break, and this might be overcome by the use of stranded steel wire instead of copper. With this improvement, and renewal of the cells when the voltage of each falls below 1·3, this telephone would remain in order under all normal conditions.

The lines for field telephones are made of steel wire, which possesses greater mechanical strength than copper wire, and is, therefore, not so easily broken. A thin, single-stranded steel wire, with an insulation of varnish, is much used when a temporary communication has to be established, or when a body of men moving forward have to keep in touch with the rear. Such a wire has the advantage of lightness, and a considerable length may be contained on a small reel. For work of a more permanent character, wires composed of several steel strands, and insulated with rubber and woven fabric, are used, and are less liable to short circuits to earth than the former. Reels of different sizes, according to the length of wire contained, are employed; the smaller reels are carried on a body-belt by the lineman, whilst the larger are mounted on special barrows. The lines are laid on the surface, or placed a few inches underground, according to circumstances, and in the latter case perfect insulation is absolutely necessary. In laying a surface wire between two stations, the safest route, even if circuitous, is taken. Open spaces are avoided, the wire being laid along a hedgerow in preference to crossing a field. If a road has to be crossed, two trees or other suitable objects are chosen, the line to be tied to the base of the first tree and drawn tightly up the trunk, and then passed over a suitable fork at a minimum height of 15 ft. It is then passed over a fork on the opposite tree, drawn tight across the road and down the trunk, and secured at the base. In the absence of trees or poles the line must be buried in the road. A line should, if possible, be kept at least 10 yards away from any other line, otherwise induction effects will give rise to overhearing in both, and cause confusion.

The breaking of telephone lines by fragments of bursting shells is a very common occurrence, and as the cutting-off of communications may have very serious results, measures are taken to maintain a complete circuit as long as possible. To this end multiple lines are used, and one arrangement, known as the "ladder"

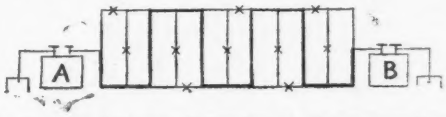


Fig. 3.—The "Ladder" System of Telephone Lines.

system, is indicated in fig. 3. The wire is formed into a network resembling a ladder, with a connection at either end to the telephones A and B. Although numerous breaks may occur, as indicated by the crosses, a continuous circuit from A to B, marked out by the thick line, still exists. Networks of this kind are sometimes buried in the ground, and enable communication to be kept up for long periods. The method has two drawbacks: first, a large number of joints have to be made during laying; and, secondly, each break is liable to cause a short circuit to earth, difficult to locate, which would prevent messages passing between the two ends.

An alternative method is shown in fig. 4, where four lines are laid between the telephones A and B, which at one spot are brought to junctions D in a dug-out, where a lineman is placed provided with a telephone, C. It must be understood that the lines, shown parallel in the drawing, may take widely different routes between the ends and the dug-out. As indicated by the crosses, all the lines are broken; 1 and 4 on the right, and 2 and 3 on the left of D. By joining each line in turn to the telephone C, these breaks and their bearings may be discovered; thus, by connecting to 4 it will be found possible to communicate with A, but not with B, and hence a break on this line between D and B is inferred. Similarly it would be found that 2 is whole between D and B, but broken on the other side. By joining the whole portions of the lines 4 and 2, or 1 and 3, at the junction-box D, a continuous line between A and B is again established. Knowing the direction of the breaks, the lineman takes a favourable opportunity of repairing them, the repair being executed by laying bare the wires at the broken ends and tying them together by a reef knot, the bare part being then insulated with rubber tape or tubing. This method has the advantage that a break may be located, and that a broken line which causes a short circuit to earth may be disconnected until the broken part has been repaired.

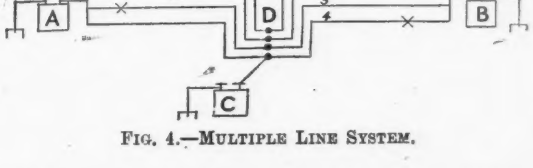


Fig. 4.—Multiple Line System.

When several telephones require to be kept in touch, an exchange is used. A battery commander may thus communicate with his observer, ammunition wagons, and guns, or any of these units with each other. A small portable exchange, provided with plugs or switches, is used in this and similar cases.

The office of field telephonist is one of great responsibility. He must be capable of keeping his instruments in order, and of executing ordinary repairs such as re-wiring the parts. He must be capable of laying lines, detecting and locating breakages, and repairing them satisfactorily. He must also be able to transmit and receive messages by Morse code at a minimum rate of 12 words per minute. He is often compelled to act in an emergency, frequently at the risk of his life, in order to restore or keep up communication. His everyday duties demand knowledge, skill, and courage, and are important in the highest degree.

The training of a field telephonist cannot be accomplished by drill alone. He must, if he is to be thoroughly reliable, possess a knowledge of the working parts of his instrument, so as rapidly to detect and rectify a fault. And this leads me to suggest that science teachers throughout the country might with advantage be used to impart this necessary knowledge in all localities where special instruction is not available. Such instruction should be carried out on an approved plan, and would require co-operation with the military authorities, in order that the actual instruments might be available for demonstration. By this means an abundance of reliable men could be secured in a short time, and with little expense.

THE ELECTRICAL EQUIPMENT OF THE ARGENTINE BATTLESHIP "MORENO."

By H. A. HORNOR.

(*Abstract of paper read before the* American Institute of Electrical Engineers.)

(*Concluded from page* 352.)

The third division of the electrical equipment is classified under the head of interior communication systems, although a few of these are solely for exterior use.

The systems comprising this division are given in the following list:—

Call bells.
Reply signals for mechanical telegraphs.
Fire alarm.
Electric clock.
Shaft revolution and direction indicators.
Electric log indicator.
Fuel oil indicator.
Ammunition hoist indicators.
Gun firing.
Engine revolution order telegraph.
Helm angle and steering telegraph.
Turret telephone.
Fire control telephone.
12 in. (304·8 mm.) fire control telegraph.
6 in. (152·4 mm.) fire control telegraph.
Turret danger zone.
Turret tell-tale.
Engine order telegraph.
Fire room telegraph.
Turret salvo.
Torpedo defence salvo.
Anchor handling.
Coal bunker alarm.
Boiler firing.
Boat hour gong.
Day battle salvo.
General alarm.
Cease firing.
Torpedo firing.
General telephone.
Captain's telephone.
Fire and engine-room telephone.
Azimuth.
Course telegraph.
Gyroscopic compass.
Pyrometer.
Anemometer.
Electric whistle.
Wireless telegraph.

These systems are supplied with power from two stations on the vessel, the forward interior communication room and the forward dynamo room. There are two central signalling stations, one forward on the upper platform deck below armour and the other on the gun deck aft. The vessel is further provided with two conning towers, one forward and one aft; two observation towers; and several gun control stations.

A number of these equipments operate on 220 volts direct current, supplied in duplicate from the forward and after main distribution switchboards. However, certain of the telegraph systems require 120 volts alternating current; others, such as the telephone system, clock system, call bell system, require 15 volts direct current; and the fire control telephone system requires 35 volts direct current. These transformations are accomplished by means of small motor-generators, usually supplied in duplicate. The A.C. motor-generators, which are rated at 18 KW. single-phase, 50 cycles, 120 volts, being of rather large size are located one in each dynamo room. The A.C. control panel is located in one of the compartments constituting the forward central station. Supply to this panel is brought directly from the control panel of the after motor-generator set and, *via* the after interior communication control panel, from the forward motor-generator.

The 15-volt D.C. motor-generators are both located in the forward dynamo room directly below the after interior communication control panel, which contains a panel especially for this distribution. Thus the after interior communication switchboard contains three panels; one for the distribution of 220-volt D.C. circuits, one for the 15-volt D.C. circuits, and one for the 120-volt A.C. circuits. The forward interior communication switchboard contains two panels, one distributing 220 volts D.C. and the other 35 volts D.C. This switchboard receives energy from the two 35-volt D.C. motor-generators for the fire control telephone system and the two ringing motor-generators for the general telephone system. It also supplies 220-volt D.C. to the two motor-generators for the gyroscopic compass system. The 220-volt bus bars are energised directly from the after main distribution switchboard, and also from the forward main distribution switchboard *via* the after interior communication switchboard. Every possible precaution has been taken to avert any failure of operation due to lack of supply or interruption of service. A diagram of the bus-bar connections is cut into the face of all switchboards, and these grooves are filled in with coloured paint.

There are about 16 telegraph systems, such as Engine Order Telegraph, Course Telegraph, &c., which are operated on the principle of an unbalanced circuit, *i.e.*, when the circuit is undisturbed no current flows. Thus a constant A.C. field, which changes its direction corresponding to the periods of the exciter current, induces currents in the armature coils. The armature of one motor—let us say transmitter—is wound with three interconnected coils and connected by three wires directly to the armature coils of the receiver motor. The power in the armature windings depends upon the rotative position of the armature coils in the field of force. If the armatures of the transmitter and receiver have the same position relatively to the field, then the induced E.M.F.'s will be of the same value and the wires between the two armatures will carry no current. If the armature of the transmitter is moved so as to unbalance the armature circuit, then current flows in the armature windings and produces a torque, and the armature of the receiver turns to the same position. When this occurs the equalising currents disappear, and with them the torque.

Any desired number of orders can be arranged for transmission, and any number of receivers connected to the transmitter, without increasing the number of connecting wires. Five wires are needed for a simple circuit, two for the field and three for the armatures. For repeating instruments two sets of motors are employed. The transmitter motor is usually larger than the receiver motor, due to the fact that it often operates a number of receivers. Energy is delivered to this apparatus from a 120-volt A.C., single-phase, 50-cycle motor-generator, *via* a step-down transformer, which lowers the pressure to 50 volts.

These instruments have a large and varied use, as shown in the above list: sending orders from the bridge to the engine room indicating the position of the rudder direct from the rudder stock to the navigator, giving orders for a change in course of the vessel, transmitting emergency orders from the bridge or conning tower when the regular steering gear is deranged, ordering small changes in speed when in squadron manœuvres, furnishing signals from the gun-firing station to each and every gun, and many other purposes too numerous to record.

There are six boiler rooms on the vessel, from each of which are led three uptakes to the two smoke-stacks. Each uptake is provided with a base-metal thermocouple pyrometer. Nine of these 18 couples indicate at two stations, one in the forward boiler room hatch, and one in the after boiler room hatch. The indicators are of the low-resistance type, mounted in special water-tight cases and provided with a nine-point switch for the purpose of reading each uptake temperature. The thermocouples are formed of a nickel alloy wire, and capable of constantly measuring a temperature of 1,800° F., and intermittently up to 2,000° F. The head of the couple is specially arranged for mechanical protection and water-tightness.

The anemometer is an unusual equipment for battleships. The apparatus consists of a transmitter comprising a pivoted rotative vane carrying at one end a fan. The vane in orientation and the fan shaft through a worm gear translate their movements by means of electrical contacts. Thus the velocity and direction of the wind may be recorded. The instrument for the *Moreno* was ordered from France, and registers 16 directions. The direction and velocity of the wind are checked off by the pen on the registering chart in increments of one mile every time the wind changes. The maximum record for the chart is 62·13 miles, and when the pen reaches this point it automatically returns to zero. The transmitter is located on the top of the forward cage mast, and the registering apparatus in the central station. It requires five wires between transmitter and register, and operates on approximately four primary cells.

Each of the three main turbine propelling shafts is equipped with a contact-maker for indicating the number of revolutions, and a contact-maker for indicating the direction of the shaft, both located in the engine room; a synchronising clock and indicator also located in the engine room, near the working platform; and three indicators located in the pilot house, forward conning tower, and central station. Eight wires are required to each indicator, three for the direction tell-tale and five for indicating the speed. Energy for operation is taken from the 15-volt bus-bars of the after interior communication switchboard. This apparatus is manufactured in Italy, and is known as the Molinari speed indicator.

The direction contact-maker is a simple make and break contact operated directly from the shaft through chain and gearing.

The revolution contact-maker consists of a lignum-vitæ cylinder carrying three brass sectors made flush with the periphery. It is located near the main shaft, and arranged to turn at the same rate of speed. It is provided with two brushes insulated from each other and mounted on spring blocks.

The synchronising clock controls the make and break contacts of the revolution contact-maker, so that these impulses may be interpreted by the indicator in measured time. A flat commutator provided with three segments, insulated from each other, is mounted in the clock, and traversed by a metal brush. In this particular installation the "long-make" segment is designed to be maintained for a period of 15 seconds, and the two "short-make" segments two seconds each. In this manner the speed during the 15 seconds previous to reading the indicator is correctly measured. The indicator consists of a train of clock gears actuated by a spring.

The wireless telegraph apparatus is of German manufacture, and known as the Telefunken "quenched-spark" variometer system. The set is rated as 5 KW. in the antenna, with a primary power of 8 KW. The advantage of the variometer principle is that it permits of a variable range of wave length, which range may be chosen between 600 m. and 2,000 m., depending upon the capacity of the aerial.

The motor-generator set is supplied with a double feeder from both of the main distribution switchboards. This set consists of a 220-volt D.C. motor of 18 H.P. and an A.C. generator rated at 8 KW., 500 cycles, 220 volts. The normal speed of the set is 1,500 R.P.M., but can be varied for the purpose of altering the spark frequency, and thereby the note of the transmitter, about 20 per cent. in either direction. The pitch of the transmitter note can also be adjusted very exactly by varying the field of the generator.

A straight-core transformer steps up the 220-volt pressure to 8,000 volts. A primary choke coil is connected in series with the low-tension winding of the transformer. When the large capacity (five Leyden jars) is used, the choke coil is used as a quenching coil in parallel with the emergency key, *i.e.*, this coil prevents severe sparking when the emergency key is brought into action.

A secondary choke coil is connected in series with the high-tension winding of the transformer. This choke coil not only affords protection against high frequency, but also provides resonance between the transformer and the excitation current.

The closed oscillatory circuit of the transmitter consists of a battery of four or five Leyden jars of a capacity of 0·01 to 0·013 microfarad each. Four or five of these jars can be connected by means of a sliding contact as may be required. Next there is provided a 16-part quenched-spark gap which is air-cooled (maximum number of gaps to be used, 12) and a primary variometer. This latter consists of three fixed and two movable coils, which can be connected either in series or parallel by means of a switch. This gives a variable inductance in the ratio of 1 to 16. The variometer scale is graduated so as to enable any wave length to be adjusted in a moment.

The antenna will be of the L type, slanting from the foremast to the mainmast. The direct distance is 196 ft., and the hypotenuse 206 ft. The antenna capacity has been fixed to absorb an oscillatory energy of 5 KW. without loss. In this circuit is the antenna variometer, which consists of six fixed and five movable coils arranged in two groups. By means of the scale and the corresponding curves, waves up to 1,450 m. can be adjusted. For waves above this a lengthening coil is connected in series with the variometer, which increases the wave range to 2,000 m.

For receiving purposes a crystal detector is used; it operates without any auxiliary E.M.F., and the receiving apparatus does not contain a local battery. By its use the connections are very much simplified. Underneath the variable receiving transformer is a two-pole change-over switch marked "long waves" and "short waves." When the switch is on the position "short waves," the connections are as follows: Antenna lengthening coil, variable condenser, earth or counterpoise. When the switch is on the position "long waves," the lengthening coil and variable condenser are connected in parallel to form a closed oscillatory circuit. The antenna now is connected to one pole of the condenser and the earth or counterpoise to the other.

With both methods of connection, the energy is transferred from the low-tension transformer coil, which is in series with the antenna, into the high-tension transformer coil. The latter forms, with the detector, an aperiodic circuit. This requires only one circuit to be tuned, viz.—for "short waves" the antenna circuit, and for "long waves" the closed oscillatory circuit. Means are also provided for increasing the capacity of the receiver through an intermediate circuit, whereby disturbances from other stations and atmospheric discharges may be avoided.

The design of this apparatus is such as to provide every means for the protection of the apparatus and operator from high tension. Behind the vertical frame of the receiver is a high-tension terminal and the high-tension switch, to which the leads from the antenna and the transmitter are connected. By this means the antenna is connected to the receiver and the transmitting circuit automatically interrupted.

This equipment had a guaranteed range of 1,000 km. by day and 2,100 km. by night. That these guarantees will be exceeded in practice is seen in the report of trials on the sister ship *Rivadavia*, where communication was held between Boston and Colon, a distance of approximately 2,000 miles (3,218 km.).

The gyroscopic compass is of German manufacture of the Anschütz type.*

The master compass receives its energy from duplicate motor-generators. The motor-generator transforms the 220-volt direct current to three-phase alternating current at 120 volts and 333 cycles. The alternator has 16 poles and runs at a normal speed of 2,500 R.P.M.; therefore the gyro motor, which has two poles, runs at approximately 20,000 R.P.M. A control panel is provided upon which are mounted meters, switches, fuses, &c.

The peripheral speed of the gyro is 500 ft. per second, or 340 miles per hour. The air friction is so great that it absorbs 95 per cent. of the power of the gyro-motor. The directive force on the gyro-compass is approximately 15 times as great as that of a magnetic liquid compass, free from all disturbances. The gyro-compass, unlike the magnetic compass, points to the true north pole of the earth.

The equipment, as a whole, is the largest and most costly ever installed in the United States, comprising 3,000 electric lights, 4,000 rated H.P., and approximately 76 miles of cable. It is a noteworthy engineering achievement in that it was a departure from American practice in the use of 230 volts; in the employment of lead-covered, steel-armoured conductors; in the application of 220-volt tungsten lamps; in the use of electricity for the purpose of steering the vessel and operating the anchor and the bilge pumps; and many more advances in the application of electrical power. The result has been fruitful to the American manufacturer in that he is now prepared to furnish standard 230-volt apparatus designed for use on shipboard. This equipment also stands as a practical solution of the many problems involved and as a working comparison with previous equipments.

Patents and Alien Enemies.—Application has been made to the Board of Trade to avoid or suspend patent No. 5,198/08, granted to Miele, by Messrs. T. Gameson & Sons, Ltd., of Walsall.

* See ELECTRICAL REVIEW, December 1st, 1911, for full illustrated description.

TRADE STATISTICS OF INDIA.

THE following figures of the imports of electrical and similar goods into British India in the year ended March 31st, 1914, are taken from the recently issued official trade statistics; details for the year ended March 31st, 1913, are added for purposes of comparison, and notes of any increases or decreases are given.

	1912-13. £	1913-14. £	Inc. or dec. £
Brass, wrought.—			
From Great Britain ...	34,000	49,000	+ 15,000
,, Germany	10,000	18,000	+ 8,000
,, Italy	8,000	11,000	+ 3,000
,, Other countries ...	20,000	31,000	+ 11,000
Total	72,000	109,000	+ 37,000
Copper and copper ware.—			
From Great Britain ...	813,000	1,354,000	+ 541,000
,, Germany	653,000	866,000	+ 213,000
,, Belgium	7,000	61,000	+ 54,000
,, France	28,000	170,000	+ 142,000
,, Austria	5,000	3,000	− 2,000
,, Japan	61,000	274,000	+ 213,000
,, Other countries ...	14,000	17,000	+ 3,000
Total	1,581,000	2,745,000	+ 1,164,000
Iron wire.—			
From Great Britain ...	55,000	74,000	+ 19,000
,, Germany	47,000	38,000	− 9,000
,, Belgium	23,000	15,000	− 8,000
,, Other countries ...	26,000	33,000	+ 7,000
Total	151,000	160,000	+ 9,000
Iron and steel plates and sheets.—			
From Great Britain ...	3,194,000	4,723,000	+ 1,529,000
,, Germany	284,000	328,000	+ 44,000
,, Belgium	147,000	155,000	+ 8,000
,, United States ...	200,000	33,000	− 167,000
,, Other countries ...	1,000	4,000	+ 3,000
Total	3,826,000	5,243,000	+ 1,417,000
Locomotives (excluding those for railways).—			
From Great Britain ...	62,000	104,000	+ 42,000
,, Germany	9,000	19,000	+ 10,000
,, Other countries ...	1,000	—	− 1,000
Total	72,000	123,000	+ 51,000
Prime movers, other than locomotives.—			
From Great Britain ...	312,000	512,000	+ 200,000
,, Germany	8,000	28,000	+ 20,000
,, United States ...	5,000	7,000	+ 2,000
,, Other countries ...	2,000	8,000	+ 6,000
Total	327,000	555,000	+ 228,000
Electrical generators.—			
From Great Britain ...	32,000	20,000	− 12,000
,, Austria-Hungary ...	6,000	—	− 6,000
,, Other countries ...	—	1,000	+ 1,000
Total	38,000	21,000	− 17,000
Electrical motors.—			
From Great Britain ...	76,000	83,000	+ 7,000
,, Germany	12,000	5,000	− 7,000
,, United States ...	4,000	3,000	− 1,000
,, Other countries ...	7,000	2,000	− 5,000
Total	99,000	93,000	− 6,000
Other electrical machinery.—			
From Great Britain ...	91,000	195,000	+ 104,000
,, Germany	6,000	30,000	+ 24,000
,, Italy	3,000	2,000	− 1,000
,, United States ...	3,000	2,000	− 1,000
,, Other countries ...	—	3,000	+ 3,000
Total	103,000	232,000	+ 129,000
Mining machinery.—			
From Great Britain ...	50,000	64,000	+ 14,000
,, Germany	1,000	2,000	+ 1,000
,, United States ...	11,000	28,000	+ 17,000
,, Other countries ...	1,000	2,000	+ 1,000
Total	63,000	96,000	+ 33,000
Railway carriages, &c.—			
From Great Britain ...	1,495,000	2,988,000	+ 1,493,000
,, Belgium	22,000	25,000	+ 3,000
,, Germany	65,000	116,000	+ 51,000
,, Other countries ...	2,000	2,000	—
Total	1,584,000	3,131,000	+ 1,547,000

	1912-13. £	1913-14. £	Inc. or dec. £
Rails and fishplates.—			
From Great Britain ...	769,000	874,000	+ 105,000
,, Germany	7,000	5,000	− 2,000
Total	776,000	879,000	+ 103,000
Machinery, other (except textile, agricultural, and printing).—*			
From Great Britain ...	574,000	753,000	+ 179,000
,, Germany	45,000	64,000	+ 19,000
,, Belgium	5,000	2,000	− 3,000
,, United States ...	31,000	35,000	+ 4,000
,, Other countries ...	10,000	33,000	+ 23,000
Total	665,000	887,000	+ 222,000

* The details for the two years are not strictly comparable, those for 1912-13 including some items which were not included in 1913-14.

Locomotives and tenders, and parts thereof.—			
From Great Britain ...	596,000	1,203,000	+ 607,000
,, Germany	7,000	59,000	+ 52,000
,, Other countries ...	—	7,000*	+ 7,000
Total	603,000	1,269,000	+ 666,000

* Belgium, £7,000.

Electrical instruments, apparatus, &c.—			
From Great Britain ...	432,000	546,000	+ 114,000
,, Germany	54,000	43,000	− 11,000
,, Belgium	4,000	7,000	+ 3,000
,, Austria	7,000	14,000	+ 7,000
,, United States ...	34,000	79,000	+ 45,000
,, Other countries ...	21,000*	27,000	+ 6,000
Total	552,000	716,000	+ 164,000

* Italy, £15,000.

Electric fans.—			
From Great Britain ...	20,000	32,000	+ 12,000
,, Italy	14,000	16,000	+ 2,000
,, United States ...	19,000	23,000	+ 4,000
,, Germany	3,000	4,000	+ 1,000
,, Other countries ...	1,000	7,000	+ 6,000
Total	57,000	82,000	+ 25,000
Electric lamps and parts.—			
From Great Britain ...	33,000	42,000	+ 9,000
,, Germany	8,000	9,000	+ 1,000
,, Austria	2,000	6,000	+ 4,000
,, Japan	2,000	1,000	− 1,000
,, United States ...	2,000	1,000	− 1,000
,, Other countries ...	2,000	2,000	—
Total	49,000	61,000	+ 12,000
Electric wires and cables.—			
From Great Britain ...	132,000	144,000	+ 12,000
,, Germany	15,000	5,000	− 10,000
,, Belgium	2,000	3,000	+ 1,000
,, Other countries ...	2,000	6,000	+ 4,000
Total	151,000	158,000	+ 7,000
Scientific, &c., instruments.—			
From Great Britain ...	80,000	82,000	+ 2,000
,, Germany	4,000	5,000	+ 1,000
,, United States ...	2,000	2,000	—
,, Other countries ...	6,000	3,000	− 3,000
Total	92,000	92,000	—
Telegraph construction materials.—			
From Great Britain ...	8,000	7,000	− 1,000
Telephone construction materials.—			
From Great Britain ...	19,000	22,000	+ 3,000
,, Germany	1,000	1,000	—
Total	20,000	23,000	+ 3,000

In addition to the foregoing, the following were imported as Government stores:—

Instruments, apparatus, &c. (except musical).—			
From Great Britain ...	136,000	135,000	− 1,000
,, Germany	3,000	1,000	− 2,000
,, Other countries ...	—	1,000	+ 1,000
Total	139,000	137,000	− 2,000
Machinery.—			
From Great Britain ...	169,000	201,000	+ 32,000
,, Germany	1,000	1,000	—
,, United States ...	3,000	1,000	− 2,000
,, Other countries ...	—	1,000	+ 1,000
Total	173,000	204,000	+ 31,000
Iron wire.—			
From Great Britain ...	10,000	12,000	+ 2,000
Iron and steel plates and sheets.—			
From Great Britain ...	50,000	82,000	+ 32,000
Railway carriages.—			
From Great Britain ...	734,000	1,209,000	+ 475,000
,, Other countries ...	—	6,000	+ 6,000
Total	734,000	1,215,000	+ 481,000
Locomotives.—			
From Great Britain ...	482,000	612,000	+ 130,000
Rails and fishplates.—			
From Great Britain ...	198,000	385,000	+ 187,000
Telegraph construction materials.—			
From Great Britain ...	72,000	97,000	+ 25,000
Copper and copperware.—			
From Great Britain ...	97,000	102,000	+ 5,000
,, Other countries ...	58,000	68,000	+ 10,000
Total	155,000	170,000	+ 15,000

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Reducing Gearing.

An apparatus for obtaining reduced speeds from high-speed electrical machinery, steam turbines, &c., is shown herewith. It is called a "turbo-gear," and consists of a large internal double-helical gear, a double-helical pinion, and three intermediate double-helical gears. The internal gear is an open-hearth steel forging, and is heat-treated to increase its ductility and to ensure uniform hardness. The pinion is cut integral with the high-speed shaft,

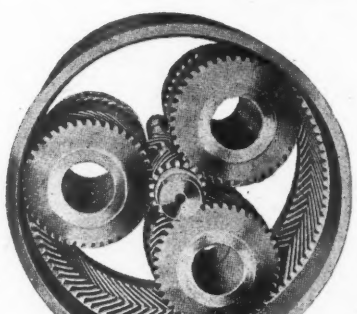


Fig. 1.—Internal Members of Speed-Reducing Device.

and is of chrome-vanadium steel heat-treated in an electric furnace to resist wear. The intermediate gears are of Lumen manganese-bronze and are mounted on hardened forged steel shafts secured to the cast-steel low-speed member by means of a taper fit and Woodruff keys. The low-speed member, to which is secured the low-speed shaft, is mounted on heavy-duty SKF ball-bearings and is supported directly by the heavy housing. The low-speed member and shaft carrying the intermediate gears and the high-speed shaft and pinion are supported independently of each other.

The housing is of cast-iron and is split horizontally. It is well ribbed, the manufacturers claim, to provide a rigid support for the gear members. The high-speed shaft is provided with a central passage through which oil is pumped, and a continuous stream of oil is sprayed on the gears through radial passages in the pinion. The high-speed bearings are also provided with oil rings. The superfluous oil from the high-speed bearings is collected by a centrifugal oil ring and forced through the hollow shafts carrying the intermediate gears, flushing their bearings. The oil after lubricating the bearings and gears is drained to the main oil reservoir in the base of the housing, where it is strained, cooled, and returned to the pump and used over again. The device shown in the accompanying illustration is designed to transmit 120 H.P. at a speed of 6·66 : 1. It is manufactured by the Turbo-Gear Co., Industrial Building, Baltimore, Md.—*Electrical World.*

Combined Switch and Indicator.

A neat combination device for small cooking and heating apparatus has been brought out by the Hart Manufacturing Co., of 76 and 77, Rochester Row, Westminster, S.W. As illustrated herewith, it consists of a push-button switch, three-way receptacle

and plug, and an illuminated bull's-eye, which indicates when current is on, thus safeguarding against accidental oversight of

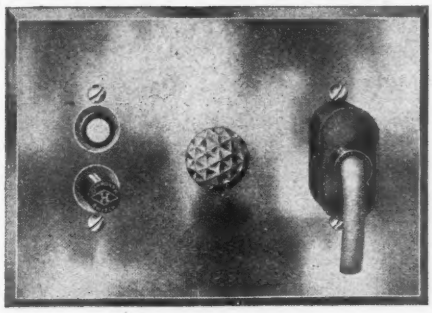


Fig. 2.—Combined Switch and Socket, with Indicator.

the fact. A similar device without the plug and socket is also made, and the carrying capacity of the parts is 750 watts.

OUR LEGAL QUERY COLUMN.

"Inquirer" writes: "I am connected with an electric supply undertaking for which the Board of Trade granted a Provisional Order in 1901, the said Order being taken over by me, by an agreement with the Corporation in 1905, by which the supply of current for lighting purposes was agreed not to be charged at a higher rate than 5d. per B.T.U. In view of the increased cost of generating, due to the war, the company which was formed to carry out the Provisional Order has applied to the said Corporation to be allowed under the present circumstances to increase the price by 10 per cent. The Corporation have refused the application. What is the position of the company? Can it reasonably expect the Board of Trade to bring pressure to bear on the Corporation to grant what appears to be a reasonable request, owing to the present exceptional conditions prevailing due to the war? The last dividend paid was for the year 1913. No dividend was paid for the year 1914, and it is improbable that any will be paid this year."

*** With reference to the above query, it is clear that **"Inquirer" has no legal right** to compel the Corporation to allow him to supply current at a higher price. The war has not had effect to dissolve or modify the contract, and it is not easy to say, in the total absence of any authority or precedent on the matter, what the attitude of the Board of Trade would be. They might say that they had no jurisdiction to interfere, but it would be well worth "Inquirer's" while to bring the matter before them. He could lay stress on (*a*) increased cost of production due to war; (*b*) diminution of demand owing to economy and police regulations; (*c*) the fact that he would be content to accept a temporary modification of terms.

Another plan would be simply to give due notice to consumers and then refuse to supply any consumer in future except on the terms of his paying the added rate, and let the consumers take the matter into Court if so advised. The feasibility of this method of dealing with a difficult situation depends on the terms existing between "Inquirer" and his consumers, as to which one can only speculate. A letter to the Board of Trade setting out all the facts may work wonders.

"One Interested" writes:—"An electric supply company has a contract with a local authority under which it supplies electric current for a certain number of lamps in the district The last agreement was made for a period of four years, and a fixed sum was to be paid per lamp per annum. This was to be made by quarterly payment, and each quarter's payment was to be due the month following the end of the quarter. Since the beginning of this year the local authority have become, apparently, somewhat nervous, and they ceased all the public street lighting, on the ground that this was desirable for military and naval purposes, although, as a matter of fact, the majority of the lights are invisible from the sea. The local authority claim that they are only called upon to pay for such lights as are now actually kept lit, and are refusing to pay any further sum. They claim that they are entitled to do this, but that as soon as the war is over they are entitled to continue the contract under the old conditions. The electric supply company argues that it is perfectly willing to make some concession to the local authority. In fact, it made a voluntary offer to do this, but it claims that as it has had to spend large sums of capital in obtaining the necessary machinery, laying the required cables, and erecting the lamps for street lighting, and for this outlay it borrowed money on debenture, the interest upon which is payable as a first charge, it is therefore entitled, in any event, to receive a sum equal to the interest payable on the debentures issued to provide for the capital outlay made for this purpose and to provide for depreciation thereon.

"The company would like to know your views upon this question, and also as to whether it is justified in claiming, that as the local authority have committed breaches of the agreement by not paying upon the prescribed scale in the prescribed time, the contract is annulled, and that if any current is to be supplied in the future it must be done under a new contract and on fresh terms."

*** It is presumed that the company in question supplies electricity under a provisional order which incorporates the provisions of the Schedule to the Electric Lighting (Clauses) Act, 1899. Approaching the query from this point of view, it is clear that by S. 27 (2) (b) of that schedule it has power to protect itself. It is there provided that: "Every owner or occupier of premises requiring a supply of energy shall . . . if required by the undertakers, enter into a written contract with them to continue to receive and pay for a supply of energy for a period of at least two years of such an amount that the payment to be made for the supply, at the rate of charge for the time being charged by the undertakers for a supply of energy to ordinary consumers within the area of supply, shall not be less than 20 per cent. per annum on the outlay incurred by the undertakers in providing any electric lines required under this Section to be provided by them for the purpose of the supply, and if required by the undertakers give to them security for the payment to them of all moneys which may become due to them by the owner or occupier in respect of any electric lines to be provided by the undertakers, and in respect of energy to be supplied by them."

If the agreement between the company and the local authority contains any clause embodying these provisions, it is clear that a remedy is to hand; but in the absence of any such terms, the remedy is not so obvious. It is difficult to advise with certainty without having access to the agreement itself, especially in view of the statement that "a fixed sum was to be paid per lamp per annum." Does this mean, "whether that lamp be lit or not" or is it to be implied that nothing is to be payable if the local authority, for reasons which do not concern the company, decide not to use any energy at all? Upon the whole, one inclines that it was to be implied that, during the currency of the agreement, the local authority were bound to pay for such lighting as would, in the ordinary course, have been used for illuminating the streets, and if they have not lit the lamps it is their own look-out. Their action in refusing to pay except for the lamps actually lit would probably justify the company in treating the contract as at an end, and refusing to supply any further light except upon special terms. Before taking this step, however, it would be desirable to take a legal opinion founded upon the terms of the agreement, the correspondence, and all other relevant documents.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

NORTHERN RHODESIA.—Under a new tariff which has recently been put into force, goods of British origin not otherwise mentioned in the tariff, a heading which includes a number of electrical goods, will pay duty at the rate of 9 per cent. *ad valorem*. Similar goods of foreign origin will pay 20 per cent. *ad valorem*. The new tariff came into force on May 1st last, and will remain in force until July 31st, 1916, unless otherwise enacted.

VENEZUELA.—The Board of Trade have been advised by H.M. Minister at Caracas that British exporters of goods to Venezuela should take care that the goods are declared in the Consular invoice strictly in accordance with the denominations employed in the tariff, otherwise the consignee in Venezuela is liable to a fine.

SOUTH AFRICA.—The South African Government Gazette of July 23rd contains a Government notice giving the text of a Proclamation relative to the duties leviable on goods imported into the Territory, hitherto known as "German South-West Africa." Under this proclamation it is provided that the importation of goods into the said Territory is permitted subject to the following conditions:—

1. Subject to the provision of paragraph (2) of this Proclamation, Customs duties shall be paid on all goods imported into the said Territory. Those duties shall, for the present, and until further provision is made, be in accordance with and subject to the tariff fixed in respect of the Union of South Africa as set out in the Union Act No. 22 of 1914, as amended by Act No. 22 of 1915, and the Customs laws and regulations in force in the Union of South Africa shall, until further provision is made, *mutatis mutandis*, have force and effect throughout and in respect of the said territory.

2. Goods which are grown, produced or manufactured in the Union of South Africa shall, when imported into the said territory, be free of Customs duty.

3. In the case of goods imported through the Union of South Africa into the said territory, the Customs duties as aforesaid shall be paid to the Collectors of Customs in the Union.

4. Goods shall be imported by sea into the said territory only through the ports of Walvis Bay and Luderitzbucht and by land into the said territory only by rail.

5. Goods imported from or through the Union of South Africa shall be accompanied by a copy of Export Form No. 41, as set out in the Schedule to the Union regulations under Government Notice No. 1,094 of 1913, and such copy shall be handed by the importer, in the case of goods brought by sea to the officer of Customs at the port of entry, and, in the case of goods brought by rail, to the station master at the place of destination.

[Note.—The form No. 41 referred to in the above paragraph relates to the Bill of Entry for goods exported from the Union.]

RUSSIA.—The following goods have recently been prohibited to be exported: Asbestos in all forms and manufactures thereof; graphite; tar, youdron and asphalt; petroleum, lubricating and other mineral oils; celluloid and manufactures thereof; all metal ores; all metals, their alloys and manufactures, scrap and brack.

FRENCH COLONIES.—A Decree has been issued abrogating a previous decree which permitted the exportation of graphite without authorisation from French Colonies and Protectorates (other than Tunis and Morocco) when consigned to France, French Colonies, the United Kingdom, British Dominions, Colonies and Protectorates, Belgium, Japan, Montenegro, Russia, Serbia, and the United States.

CHILE.—The Chilean Consulate in London has notified the Postmaster-General that invoices of goods sent through the post to Chile must be vised by the Chilean Consul at the place where the goods are dispatched in all cases where the declared value exceeds £5.

ARGENTINA.—The following rules have been laid down for the presentation of bills of lading in connection with the clearance through the Customs of goods imported into the Republic of Argentina:—

These rules have been drawn up in view of the delay which, owing to postal censorship and other abnormal conditions due to the war, now frequently occurs in the receipt, by consignees in the Argentine, of the bills of lading relating to goods dispatched from European countries.

1. For the presentation of documents in connection with goods dispatched with bills of lading made out to a named consignee, the following procedure shall be followed in order that consignees may avoid the fine of 2 per cent: prescribed by Article 929 of the Customs Regulations:—

The goods may be declared for Customs purposes without the bills of lading, on the sole responsibility of the consignee, when the latter is of acknowledged standing in the town;

Should the legal period (*i.e.*, eight days) expire before the bills of lading have been produced, the Secretary of Customs shall undertake, at the request of the interested parties, to open the envelope containing the documents as soon as it comes to hand, noting the day on which the unopened envelope is submitted and the date indicated by the postmark.

2. The presentation of documents for goods consigned to order may be made, without fine, after the expiration of the legal period (eight days):—

(*a*) When the interested parties allow the Secretary of Customs to open the envelopes and packets containing the bills of lading, in the same way as is described under (1) above;

(*b*) When the interested parties present to the Customs, within eight days from the date indicated by the postmark, the envelope in which the bill of lading arrived made out "to order" and addressed to a bank.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

12,414. "Electric transmission systems." R. E. Raven. August 30th.

12,418. "Means for joining up electrical conduits." F. W. Uren & O. J. Nilsen. August 30th.

12,428. "Plug for telephone switchboards and the like." P. P. Craven. August 30th.

12,431. "Valve for controlling and governing mechanically and electrically the speed of a pump, turbine, Pelton wheel, or the like, driving a dynamo-electric machine, and also for controlling and governing the pressure on such dynamo-electric machine." W. F. Rhodes & J. Firth. August 30th.

12,434. "Loaded telephone line system." T. Shaw & W. Fondiller. August 30th. (Convention date, September 12th, 1914, United States.) (Complete.)

12,444. "Systems of electric ship propulsion." British Thomson-Houston Co., Ltd. (General Electric Co., U.S.A.). August 30th.

12,516. "Switches for resistances." L. Kamm. August 31st.

12,536. "Method of generating high-frequency electric currents." T. F. Wall. September 1st.

12,561. "Telegraph systems." British Insulated & Helsby Cables, Ltd., and H. H. Harrison. September 1st. (Complete.)

12,564. "Wireless signalling systems." British Thomson-Houston Co., Ltd (General Electric Co., U.S.A.). September 1st.

12,583. "Manufacture of electric insulating materials and the like." W. E. W. Richards. September 1st.

12,614. "Electrical signalling or distant controlling plant." Fried. Krupp Akt Ges. September 2nd. (Convention date, September 2nd, 1914, Germany.) (Complete.)

12,617. "Methods of marking glass." British Thomson-Houston Co., Ltd. (General Electric Co., U.S.A.). September 2nd.

12,630. "Selective calling devices for use in electric telegraphy." A. H. Morse & Indo-European Telegraph Co., Ltd. September 2nd.

12,666. "Rectifiers for electric currents." British Thomson-Houston Co., Ltd. (General Electric Co., U.S.A.). September 3rd.

12,671. "Impulse transmitters for automatic telephone systems." G. A. Betulander. September 3rd. (Convention date, January 26th, 1915, Sweden.) (Complete.)

12,673. "Automatic telephone systems." Relay Automatic Telephone Co., Ltd. September 3rd. (Convention date, November 17th, 1914, Sweden.) (Ccmplete.)

12,680. "Locking device to prevent the theft of electric lamps held by bayonet joints." P. E. Correll. September 3rd. (Complete.)

12,687. "Electrical aids for deaf persons." C. W. Hawksley. September 3rd.

12,702. "Electrical heating elements." H. Cheshire (trading as Cranmer and Cheshire). September 4th. (Complete.)

PUBLISHED SPECIFICATIONS.

1914.

252. Relay Arrangements for Alternating Currents. G. G. Von Arco and A. Meissner. January 5th.

12,277. Apparatus for Electric Signalling and for Controlling the Current in Electric Circuits, especially applicable to Wireless Telegraphy. A. F. Sykes & Ford. May 18th. (Cognate application, 24,259/14.)

18,464. Prepayment Electricity Meters. Landis & Gyr, Ltd. (S.A.). August 8th (August 9th, 1913.)

18,660. Electro-medical Apparatus. H. W. Cox & Co., Ltd., and H. E. Donnithorne. August 14th.

18,737. Dynamo-battery Electric Systems. G. E. Mortley. August 17th.

18,780. Electric Visual and Audible Signalling Appliances, more particularly for use in Mines. H Green & W. de Manoel Landon. August 18th. (Cognate application, 4,253/15.)

18,872. Electric Mercury Switches. G. Jacobus van Haersma Buma. August 20th.

18,887. Variable Pole Dynamo-electric and like Machines. F. Creedy. August 20th.

18,954. Electro-magnetic Circuit Controlling Devices for Railway Signalling and other purposes. J. Gardner. August 22nd. (Cognate applications 20,006/14 and 24,787/14.)

19,057. Speed-controlling Devices for Electric Motors. British Thomson-Houston Co., Ltd. (General Electric Co., U.S.A.). August 25th.

19,737. Sparking Plugs for Internal-combustion Engines and the manufacture of the same. A. A. Lines, H. G. Longford, Longford & W. A. Clark. September 14th.

19,794. Electromagnetic Switches. British Thomson-Houston Co., Ltd. (General Electric Co., U.S.A.). September 15th.

19,818. Electrically-driven Clocks. F. H. Walker. September 15th.

19,849. Treatment of Materials for Impregnating them Electro-osmotically. Ges. für Elektro-Osmose. September 16th. (September 19th, 1913.)

20,786. Methods and Apparatus for the determination of the Complex Energy delivered by Alternating Currents. R. Arno. October 9th. (Addition to 9,580/10.)

20,959. High-tension Windings for Electrical Apparatus. W. H. Wilson and F. W. Wright. October 14th.

21,189. Method of Influencing the Electrical Charge of a Diaphragm for Processes Depending on Electro-osmosis. Ges. für Elektro-Osmose. October 19th. (November 6th, 1913.)

21,389. X-ray Devices. British Thomson-Houston Co. (General Electric Co., U.S.A.). October 22nd.

21,798. Electric Incandescent Lamp Holders. C. G. M. Bennett & C. H. Jeffcoat. October 30th.

23,283. Telephone Receivers. L. Brown & C. Macintosh & Co., Ltd. November 30th.

1915.

5,591. System for the Generation of Electric Currents. C. F. Benitez. April 14th. (Addition to 17,811/14.)

5,717. Electric Switches. J. H. Tucker & J. A. Crabtree. April 16th. (Divided application on 21,175/14, October 19th.)

7,088. Electric Diaphragm Horns. A. H. Midgley & C. A. Vandervell. May 11th.

8,332. Holders for Electric Incandescent Lamps. A. H. Midgley & C. A. Vandervell. June 4th.

9,477. Means for Cooling Electrically-operated Tools. Frankfurter Maschinenbau Akt. Ges. Vorm. Pokorny & Wittekind. June 29th. (June 30th, 1914.)

"The Firebrand."—This is the title of a monthly publication which is being issued by the Pyrene Co., Ltd., of 19 and 21, Great Queen Street, London, W.C. Among other things stated in the first number (September) now before us is an announcement that the British Government has placed further orders for Pyrene extinguishers, making its total 42,000. These extinguishers are being very largely used in electrical works (Pyrene is an absolute non-conductor of electricity), and has been taken up for re-sale by large firms interested in the electrical industry. The monthly circular will keep dealers and users posted with current information regarding what the extinguishers are doing.